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GENETIC SIGNPOSTS OF PREVENTIVE MEDICINE
H. Warner Kloepfer

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CONTENTS

Utopia by Sterilization	H. L. Mencken
Cultural Factors in Economic Development	Professor Reuben E. Slesinger
Cultural Aspects of Indonesia's Demographic Problem	Professor Justus Van der Kroef
A Note on Demographic Statistics in Inda	Professor S. Chandrasekhar
Influence of Seasonal Variations on the Reproductive Cycles in Women	Mrs. Nalinee Datta
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From the Press Cuttings	
Institute's Activities	
Reviews of Books	
Publications Received	

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THE EUGENICS REVIEW

CONTENTS

April 1960 Volume 52, Number 1

Notes of the Quarter

DARWIN RESEARCH FELLOWSHIPS — SIGNS OF THE TIMES — PÈRE DE LESTAPIS ON LIMITATION OF BIRTHS — A.I.D. IN SCOTLAND — THE GUINNESS FAMILY — EDUCATION IN RUSSIA — OUR CONTRIBUTORS

Blood Groups in the Study of Human Populations	*A. E. Mourant*
Birth Control in China—Recent Aspects	*Han Suyin*
Evolutionary Systems—Animal and Human	*C. H. Waddington*
The Guinness Family	*Lord Moyne*

Notes and Memoranda

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Genetic and Eugenic Aspects of Early Total Deafness, DIANE SANK and FRANZ J. KALLMANN, M.D.
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Genetics in the Atomic Age, CURT STERN
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CONTENTS

JOHN D. DURAND.	The Population Statistics of China AD.2–1953.
LEO SILBERMAN.	Hung Liang-Chi, A Chinese Malthus.
P. J. KOBLENZER and N. H. CARRIER.	The Fertility, Mortality and Nuptiality of the Rungus Dusun.
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Vol. 7, No. 2 June, 1960

Contents

Genetic Signposts of Preventive Medicine, H. WARNER KLOEPFER 69–76

Fertility Differentials Among Economic Strata in Central India, EDWIN D. DRIVER 77–85

Evolution and the Phenomenon of Man, HELEN HAMMONS 86–95

A Proposed Standard System of Nomenclature of Human Mitotic Chromosomes, Report of a Study Group 96–100

Book Reviews

"Human Biochemical Genetics" (Harris), DAVID YI-YUNG HSIA 101–102

"An Introduction to Medical Genetics" (Fraser Roberts), JOSEF WARKANY 102–103

"Outline of Human Genetics" (Penrose), RICHARD SHAW 104

"Genetik des Menschen" (v. Verschuer), KURT HIRSCHHORN 104

"Cancer in Families" (Murphy and Abbey), HERMAN M. SLATIS 104–105

"Babies by Choice or Chance" (Guttmacher), RICHARD L. DAY 105–107

"Family Planning, Sterility, and Population Growth" (Freedman, Whelpton, and Campbell), J. MAYONE STYCOS 107–109

"Human Potentialities" (Murphy), W. R. THOMPSON 109–110

"Adam's Brood" (Bertram), GARRETT HARDIN 110–111

Notes on Recent Publications, HELEN HAMMONS 112–113

Periodical Reviews

Genetics, CHARLES M. WOOLF 114–117

Population, LEIGHTON VAN NORT 117–121

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Vol. 7, No. 2, June, 1960 *Eugenics Quarterly*

GENETIC SIGNPOSTS OF PREVENTIVE MEDICINE

H. Warner Kloepfer
Tulane University School of Medicine

Although implications are not clear, one often hears the expression "Life begins at forty." In genetics the introduction of new terms to represent the units of material that are transferred from generation to generation seems to begin at forty-three or forty-four, whether or not new terms be signposts of preventive medicine. Mendel (1866), at the age of 44 years, used the term "factor" to describe what is transferred from parents to offspring but Johanssen (1909), 43 years later, introduced the word "gene" to represent the same entity. *Forty-four* more years passed and Watson and Crick (1953a, 1953b) reported units of deoxyribonucleic acid (DNA) to be the basis of heredity. The location of DNA is still in the chromosome as was the "factor" (after 1902) and the "gene," but the new term has a definable structure and today biochemical structures command universal attention.

The new science of "deoxyribonucleicacidology" may still be the study of hereditary factors and genes, but without uncomplimentary stigmata such as "fate," "taint," and "bad" heredity. The biochemists have a reputation for doing something about their initial monumental discoveries. The discovery of the general molecular structure of vitamins and hormones was followed by the discovery of molecular structures of specific vitamins and hormones. The discovery of specific chemical structures paved the way for large-scale production of numerous vitamins and hormones for distribution through pharmaceutical supply outlets of all kinds. New industries came into being and the expected life span was extended.

Now a new effort and a new hope are in the making. A gene (DNA particle) looks something like a flexible ladder which has been twisted to include 10 rungs within each complete spiral. Just as the uniqueness of each word in the dictionary is dependent upon a specific linear arrangement of 26 possible letters of an alphabet, the uniqueness of each DNA ladder is dependent upon the specific linear arrangement of 4 possible letters (each rung in the ladder being one of four possible pairs of known amino acids: adenine-thymine, cystine-

guanine, thymine-adenine, and guanine-cystine). Learning to spell with only a four-letter alphabet may seem easy and appear to limit the number of possible words (genes), but one must not forget that each "word" contains about 10,000 letters. Can the biochemist discover the structure of specific DNA particles associated with specific deleterious mutations and their normal alleles? Can these particles eventually be synthesized one by one and used therapeutically to control the thousand or more genetic conditions caused by pathological genes (pathogenes)? Can genetic conditions be prevented by applying the artificially prepared DNA at the right time and by the right portal of entry into the body? Can normal metabolism be maintained over critical periods in the life cycle of the individual? Can the occurrence of the most dreaded hereditary diseases be avoided? The geneticist has unlimited faith that the biochemist can solve eventually the problem of DNA "spelling" and synthesis.

Before facing the signposts of the future, the geneticist might profit from a look at the fruits of a century of medical microbiological research which began soon after the improvement of the compound microscope. The results of this research have been very impressive: the accumulated knowledge is so extensive that a considerable fraction of the four-year medical curriculum is needed to communicate this progress to a medical student. Patients take for granted today that they need not die from typhoid fever, pneumonia, diphtheria, and the various other communicable diseases which were once high on the list of most dreaded diseases. However, during the period of time in which medical research effort was being concentrated on how to control non-genetic conditions, no comparable effort was being expended to control the hereditary diseases. It took half a century for genetics to be born, and during the next half century it was common practice to exclude the appointment of geneticists from medical school faculties. During this period it was popular to "prove" that conditions are not hereditary and to discredit even the possible existence of genes. However, as the non-hereditary diseases were removed from the category of the most dreaded diseases, genetic conditions such as cancer, muscular dystrophy and certain neurological, psychiatric, and cardiovascular problems became increasingly a focus of genetic research attention. (Cancer caused by a somatic mutation is genetic but not necessarily hereditary when the mutant gene is not in a potential germ cell.)

In contrast to the past century perhaps the first reason why medical research now is being directed to the study of hereditary diseases is the fact that these conditions are now so high on the list of most dreaded diseases that they can no longer be ignored. Any particular hereditary condition may occur less than once in 10,000 individuals, though of some 400 diseases of genetic origin, 1-25 individuals would be expected to have one of these conditions. It would seem that almost every person or one of his relatives has at least one undesirable hereditary condition which impairs health and happiness.

A second possible reason why medical research is now being directed to hereditary conditions could be related to the development of atomic energy. The public has learned that exposure to radiation from fall-out and from peaceful uses of atomic energy can increase the occurrence of unfavorable genetic conditions in future generations. The ge-

neticist has been made a member of the medical research team only recently; and the fact that many medical schools have had difficulty in securing genetically trained personnel does little to reduce the level of anxiety. On the other hand, the panic reaction may in itself now be an important reason why medical schools are willing to revise their curricula and architectural plans to provide for research personnel and facilities needed to understand the major genes which cause hereditary diseases. If there is a positive correlation between the amount of research attention given a group of diseases and the ability of medical science to cure or control that group of diseases, one might predict that present efforts are only the beginning of much greater ones in the future. It should be emphasized that the new mutations arising from radiation, which cause a gene to have pathological effects, are no different in principle from the many accumulated spontaneous mutations which cause genes to have pathological effects; but radiation accelerates the rate of their production.

A third factor which probably inspired genetic research in the medical school was the discovery made by biochemists that the gene has a molecular structure. The gene can be seen through the use of X-ray diffraction and the electron microscope. Before the work of Watson and Crick a student would frequently ask after a lecture in medical genetics, "Is the gene a hypothetical imaginary something which has no actual existence?" A common answer to this question was, "Molecular structures can never be seen with the compound microscope, yet the chemist knows when a specific molecule exists. The geneticist knows that genes exist in given positions on the chromosome and he believes them to have specific biochemical structure." The biochemist is a respected member of the medical research team, and when he announced that genes are biochemical entities even the reluctant medical school became willing to make a place for the geneticist on the faculty.

A fourth reason for increased interest in medical genetics research is the recent realization (Ford 1960) that irregularities (aberrations) in specific human chromosomes may be observed to occur in individuals with specific congenital anomalies such as mongolism and certain types of hermaphroditism (Klinefelder's syndrome and Turner's syndrome).

A fifth reason which may make the need for genetic research more apparent is the realization (Snyder 1959) that the gene can be an important etiological factor in the causation of all human diseases including those caused by metabolic errors and communicable agents. For example, a recent preliminary progress study on the genetics of leprosy (Belknap-Hayes, 1960) shows that a dominant gene with possibly 3/5 penetrance could be a prerequisite to an infection by Hansen's bacillus. About one in every 20,000 individuals in the population studied seem to carry this dominant gene, and 3 out of 5 of these carriers get a clinical diagnosis of leprosy if they live until 80 years of age.

Unlike the merger of the disciplines of cytology and heredity in 1902 to form the new science of genetics which must have been "love at first sight" because the two disciplines had not been courting one another previously, merger of genetics and biochemistry in 1953 succeeded a courting that had been in progress for a long time. As a matter of fact, as long ago as 1908 Sir Archbald Garrod

presented his famous Croonian Lectures on inborn errors of metabolism, in which he emphasized the fact that in four human metabolic disorders genes produce their effects through the control of specific enzymes. After extending and generalizing the ideas of Garrod, it took the winning of Nobel prizes by George W. Beadle, Joshua Lederberg, and Edward L. Tatum in 1958 to publicize further the possibilities in medical genetics. Hsia (1959) reviews 76 inborn errors of metabolism in man. Although many biochemical procedures have been used as tools by the geneticist, observations in protein chemistry and genetics followed rather independent paths until 1953, except for promising efforts in serum electrophoresis and chromatography.

The purpose of medical genetic research in the broad sense is to learn to control all pathological conditions which are caused by changes in the molecular arrangement of normal genes. These changes (mutations) sometimes behave as if a "gene deficiency" were present, although it is now well known that no mutation (pathogene) can produce an effect except by some quantitative or qualitative change in a particular enzyme. Whether the DNA code is transferred to the enzyme by way of RNA (ribonucleic acid) or by some other media, and whether the use of an alternative biochemical pathway at times is a mechanism of apenetrance (pathogene fails to cause clinical effects) when a certain enzyme does not function, or whether unidentified genes cause apenetrance, the fact remains that normal cell function is dependent upon the interaction of a multiplicity of different enzymes. One of the purposes of biochemical medical research is to learn the molecular structure of the specific gene. Thus, it can be seen that genetic research is not limited to the understanding of how pathological genes become distributed within families to cause undesirable conditions in certain individuals and not in others. Instead, an important purpose of human genetic research is to help the biochemist make his contribution to the eventual control of hereditary diseases at the level of the gene or only a few biochemical steps removed from this level.

Although the geneticist has the responsibility of extending basic knowledge about genes in all directions, the human geneticist has the special responsibility of describing each and every pathogene with the same degree of thoroughness that the microbiologist has described each and every agent of communicable disease.

Some of the problems of interest to the human geneticist are similar to those pursued by any type of genetic specialist, while other problems are of greater importance to the human geneticist and the clinician than to other disciplines in genetics. Since procedures used in the analysis of problems in human genetics are not based on controlled matings, generation times, etc., statistical methods of analysis (Neel-Schull, 1954) must be used which need not be employed in the studies of non-human organisms. The need for human genetic studies to extend knowledge about any given pathological gene may be determined by evaluating the completeness of answers to the following questions:

1. Among unrelated cases of a disease or medical condition encountered in a given population, situation, or clinical practice: (a) May no major gene be associated with the condition? (b) If the condition is genetic, may only one major gene be involved? (c) May more than one major gene cause the same or similar clinical stigmata?

2. If no major gene is involved: (a) is the condition heritable? (b) caused by a chromosomal aberration? (c) caused by polygenes? (d) are racial and constitutional factors associated with the condition?

3. For each major gene known to be associated with a given condition, are the clinical symptoms associated with the: (a) heterozygous genotype only (typical for dominant and sex-linked recessive genes)? (b) homozygous genotype only (typical for autosomal recessive genes)? or (c) both heterozygous and homozygous genotypes?

4. If more than one genetic entity can cause a given clinical syndrome or condition, with what frequency are the various genetic entities encountered in different populations?

5. For each major gene associated with a given clinical entity in a given population: (a) how can one detect the asymptomatic genetic carrier? (b) what is the penetrance of the gene? (c) what is the range of manifestation of clinical features among individuals sharing a common pathological genotype? (d) with what frequency are the various clinical stigmata encountered among individuals with the same genotype? (e) what is the frequency of the gene? and (f) what is the frequency of the carrier of the gene in the population?

6. For each major gene causing a genetic condition: (a) what is the spontaneous mutation rate of the normal allele to the pathological allele? What are (2) the linkage relationships of each pathogene? (c) the chemical formula of the specific enzyme or enzymes associated with the normal allele of the mutant gene? (d) the specific formula of the DNA associated with the normal allele? (e) the stages of the life cycle of the individual in which the abnormal metabolism may be altered to avoid the pathology? (f) the various biochemical genetic methods available for controlling the pathology?

As knowledge about specific major genes accumulates from studies of different population groups, some human genetic problems of lesser concern to the clinician but of greater concern to the theoretical human geneticist include:

1. What is the composition and extent of the "load of deleterious mutations" for various population groups?

2. How much of the variation in gene frequency among different populations can be due to specific mutagenic environments, various selective factors, etc.?

3. Is the frequency of a given major gene increasing or decreasing in a given population? What is the rate of change in the frequency of the gene? What are the factors causing the gene to change its frequency?

4. How does the rate of change of one gene compare with the rate of change of other genes in the same population?

Even though a single genetic center or one human geneticist may have the opportunity to pursue a very limited number of the questions listed about the genetics of given clinical entity, it is important to extend knowledge on all levels whenever possible. Small bits of information from a number of independent studies may then be combined to answer questions which must be based on more data.

Since procedures are now available for finding answers to most of the above questions, perhaps the most encouraging signpost toward preventive medicine is the fact that studies in medical genetics are being developed at the present time in various medical schools throughout

the nation. These programs of study are on a sound footing. The most important question no longer is "Can genetic diseases eventually be controlled?" The answer to this question can be confidently answered in the affirmative. Rather, the most pertinent question seems to be, "How much time will be required by the medical genetic research teams throughout the world to make genetic conditions controllable?" Must the size of the personnel force needed for this research effort be larger or smaller than that needed throughout the past century to bring communicable diseases under control? How will financial support of medical genetic research projects compare with that of other disciplines?

Molecular structures of specific genes are not known at present; nevertheless, prevention and control are now possible at other levels for a number of diseases. No attempt will be made to list the numerous diseases which can be diagnosed and controlled after clinical symptoms appear because it can be argued that genetic knowledge (except for possible contribution of earlier diagnosis) has contributed little if anything in these situations. For example, a cancer of the eye known as retinoblastoma may be caused by a dominant gene with reduced penetrance, but early surgery would be equally effective in saving lives if the condition were not hereditary. Perhaps one of the most promising contributions of genetics at present to prevention is for diseases meeting all three of the following criteria:

(a) Potential sufferers can be identified.

(b) Pathology may not be completely repaired or corrected after symptoms have appeared.

(c) Procedures are available to prevent the appearance of signs and symptoms when the potential sufferer can be identified.

Two rare autosomal recessive diseases which may be controlled by diet might be cited to illustrate conditions meeting these criteria. In order to assure prevention of symptoms in galactocemia, foods containing galactose sugar must be withheld from the diet in the first few weeks of life. If individuals with the homozygous genotype for this disease be undiagnosed and untreated for too long a period, they may fail to gain weight, develop an enlarged liver and jaundice; mental retardation and cataracts may result in those who survive childhood. Since heterozygous parents can be identified (Hsia 1959) by means of galactose-tolerance tests, the ¼ risk of a potentially affected offspring can be predicted in advance, and early tests may be made soon after birth to learn whether preventive steps should be initiated to preclude the development of symptoms of the disease.

A second rare autosomal genetic disease in which all cases could be prevented is phenylketonuria. To assure prevention of clinical symptoms of this disease, phenylalanine must be excluded from the diet as soon as possible after birth. Individuals who receive a recessive gene from each of their heterozygous carrier parents may develop mental retardation if undiagnosed and untreated. Since these heterozygous parents can be identified (Hsia 1959) by means of phenylalanine tolerance tests, the ¼ risk of a potentially affected offspring can be predicted in advance, and early tests can be given before symptoms appear to learn whether phenylalanine should be withdrawn from the diet.

Hereditary spherocytosis is an example of a third rare disease in which lives can be saved by preventive steps. In this

case surgical removal of the spleen may seem like a high price to pay for prevention, but the survival risk from splenectomy is quite small compared to the survival of individuals in which the spleen is not removed. In contrast to galactocemia and phenylketonuria, heterozygous genetic carriers of the dominant gene for hereditary spherocytosis are potential sufferers and these individuals may be identified in advance of clinical symptoms by appropriate tests. Except in the event of new mutation, each offspring, each sibling, and each sibling of the carrier parent has a ½ chance of being a genetic carrier in which prophylactic splenectomy should be considered.

In the instances cited, and possibly in many more to be recognized in the future, one important contribution of the geneticist seems to be the identification of genetic carriers. It would seem that greater efforts should be made to simplify and extend the tests which can be used to identify genetic carriers. Also more concern should be directed toward the use of these tests to prevent symptoms from occurring in potential sufferers. An extension of chromosome maps is another area of basic research which might have use in identifying carriers when other means are not available, and no one can foresee the possible value of such maps for the use of the researcher in biochemistry and cytology.

Although research that might lead to the control of genetic disease at the level of the gene or only a few biochemical steps removed from this level was considered impossible for a long time, it is quite likely that progress could now be swift compared to speeds of progress in other medical disciplines because so many tools developed for use in other disciplines may readily be adapted for use in genetics. Also, genetics is one of the most exact of all biological disciplines. By making use of modern human tissue culture techniques, almost any part of the human body can be placed in a test tube and made to grow there. With corresponding tissues growing from various members of a family or series of related families, all the experimental procedures developed for non-human genetic studies can be applied to studies in human genetics without waiting for F_1 and F_2 generations (See Pontecoroo, 1958). In addition the various specialized procedures developed for the study of a condition by a particular discipline of the medical school are available. For example, dermatology, otolaryngology, opthalmology, neurology, etc., each has developed special facilities for the study of specific parts of the human body which are unmatched by facilities for the study of a comparable part in any lower animal.

Depending upon the personnel and physical facilities which will be made available to genetic-biochemical and medical specialty teams, there is room for hope that the passing of signposts toward the control and prevention of the various hereditary diseases may be quite rapid and exciting.

REFERENCES

1. Belknap, Harold R. and William G. Hayes. 1960. A genetic study of families in which leprosy occurs. (Thesis for Doctor of Medicine at Tulane University School of Medicine.) 28 pp.
2. Garrod, A. E. 1908. *Lancet* **2**: 1-7, 73-79, 142-148, 214-220.
3. Ford, C. E. 1960. Human Cytogenetics: Its Present Place and Future Possibilities. *Am. Jour. Hum. Genet.*, **12**: 104-117.
4. Hsia, David Yi-Yung. 1959. *Inborn Errors of Metabolism*. The Year Book Publishers. 358 pp.
5. Johannsen, W. 1909. *Elemente der exakten Erblichkeitslehre*.
6. Mendel, Gregor. 1866. *Versuche über Pflanzenhybriden*. Verhandlungen des

Naturforschenden Vereins. Vol. IV.
7. NEEL, JAMES V. and WILLIAM J. SCHULL. 1954. *Human Heredity.* Chicago: The University of Chicago Press. 361pp.
8. PONTECORVO. G. 1958. *Trends in Genetic Analysis.* New York: Columbia University Press. 145pp.
9. SNYDER, LAURENCE H. 1959. Fifty years of medical genetics: The union of biochemistry and genetics offer a rational approach to diagnoses, prevention and therapy. *Science,* **129**: 7-13.
10. WATSON, J. D. and F. H. C. CRICK. 1953a. Molecular structure of nucleic acids: A structure for deoxyribose nucleic acid. *Nature,* **171**: 737-738.
11. ————. 1953b. The structure of DNA. *Cold Spring Harbor Symposia on Quantitative Biology.* **18**: 123-131.

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FERTILITY DIFFERENTIALS AMONG ECONOMIC STRATA IN CENTRAL INDIA

EDWIN D. DRIVER
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THE PATTERN OF POPULATION GROWTH in India will have a decisive bearing on whether the several economic and social objectives set forth in the Five-Year Plans are achieved. Over the past half-century a high mortality rate has operated to counterbalance a high and stable fertility rate, thus preventing a rapid increase in population size. In the future, however, the past influence of mortality will be lessened considerably. Deaths due to malnutrition, famines, and gastro-intestinal ailments are being decreased through improved agricultural production and distribution and the purification of water supplies. In addition, the Government of India and the World Health Organization have launched national programs of medical care and preventive medicine which, on the basis of recent surveys, appear effective in lowering the incidence of smallpox, cholera, plague, malaria, filariasis, tuberculosis, and venereal diseases. Control over these primary causes of death implies a rapid drop in the mortality rate and, on the basis of evidence gathered during the filariasis campaign, a decrease in the incidence of sterility in the population.

The potential effect of declining mortality on population growth and economic development in India is vividly described by Coale and Hoover.[1] Their estimates, which assume an increase in the average expectation of life at birth from 32 years in 1951 to 52 years in 1986, show a population of 775 millions by 1986 if no change occurs in the current fertility rate. But, if it is assumed that a 50 per cent reduction in fertility occurs in linear fashion between 1956-1981 or between 1966-1981, then the figures would be 589 and 634 millions, respectively.[2] The gain in per capita income, 1986 over 1956, would be 38 per cent if fertility did not decline, and 95 per cent, the goal of India, if the decline began in 1956.[3]

In this context, the future course of fertility has great importance. In the opinion of many demographers, a significant decline requires quick acceptance by the public of the birth control programs which have been introduced by the Government of India and voluntary associations. In the absence of deliberate controls, they argue, change should not be expected since the rate of fertility has remained constant over the past fifty years. One factor which might invalidate this argument is the fact that India's social structure which was relatively static during this period is not expected to remain so. It is therefore possible, but improbable in the short-run, that fertility patterns will be altered by

[1] *Population Growth and Economic Development in Low-Income Countries*, Princeton: Princeton University Press, 1958.

[2] *Ibid.*, pp. 34-37.

[3] *Ibid.*, p. 272.

the numerous changes in social structure and social norms produced by the Five-Year Plans and new governmental policies.

These include, among others, modifications in the proportions of persons who are educated, living in urban areas, owning land, and employed in various occupations. According to the Planning Commission, the "Second Plan will . . . begin for the first time in fifty years, barring the two war periods, to increase the proportion of persons employed outside of agriculture and it will lay the foundation in industry and elsewhere which will expand employment over the future."[4] The present 70:30 ratio of agricultural to non-agricultural employment will probably be reduced to 60:40 by 1975-1976.[5] The occupations whose representation in the total labor force is expected to increase most include: semi-skilled and skilled workers; engineers, doctors and nurses; rural extension workers; and managerial and administrative personnel.[6] An illustration of the possible extent of their increase is provided by the Second Five-Year Plan, which runs from 1956 to 1961: one goal is 750,000 *new* semi-skilled and skilled industrial workers by 1961, which number is almost equal to the total (825,000) workers of this kind found in India in 1956.[7] As indicated previously income levels are also expected to change, providing a reduction in the proportion of persons now found in the low income groups. The proportions of the population who are landless and who have large holdings may be reduced by various land reform measures.

[4]Government of India, Planning Commission, *The New India: Progress Through Democracy*, New York: Macmillan, 1958, p. 99.

[5]Government of India. Planning Commission, *Second Five-Year Plan*, Delhi: Manager of Publications, 1956, pp. 12-14.

[6]Government of India, Planning Commission, *The New India: Progress Through Democracy*, pp. 102-110.

[7]*Ibid.*

GENERAL PURPOSE

The general purpose of this paper is to determine whether there is any basis for assuming a change in fertility rates as a consequence of changes in the proportions of persons found in various occupational, income, and landownership groups. Such an assumption would seem reasonable if it is found that past and present fertility rates in India are associated with social status.

Previous Studies. When previous studies of economic status and fertility are juxtaposed, one obtains an unclear picture of the relation between these two variables. The United Nations—Government of India Survey of Mysore, using type of dwelling as an index of the economic status of the family, found a positive association between completed fertility (that of women 45 years of age or over) and upper status. Rural women living in huts had 4.4 live births, whereas those living in "mudhouses with thatched roof" had 4.5 live births and those living in still better houses had 5.0 live births.[8] Similarly, the wives of agricultural laborers had 4.0 live births, while those of small cultivators had 4.7 live births and those of large cultivators had 5.1 live births.[9] Sample surveys of Kolhapur City and Poona District by the Gokhale Institute found, when age of the woman is controlled, that high fertility is associated with both higher grade occupations and large income.[10]

[8]C. Chandrasekaran, "India's Population Problem." Unpublished Paper presented at the Inaugural Conference of the Demographic Teaching and Research Centre, Bombay, on November 5, 1957, pp. 8-9.

[9]*Ibid.*

[10]V. M. Dandekar & K. Dandekar, *Survey of Fertility and Mortality in Poona District*, Poona: Gokhale Institute of Politics and Economics, Publication No. 27, 1953, p. 67.

However, surveys by the Institute of three neighboring districts found birth rates to be independent of both occupation and income.[11]

A study of rural women in the Punjab, who had been married at least ten years, also shows virtually no difference in fertility among occupational and income groups.[12] On the other hand, Kingsley Davis, using partial census data, found variations in the ratios of children 0-6 years of age to women 14-43 years of age among occupational strata. Fertility was higher in the households of artisans and agriculturalists than in those of traders and professionals. But the differences, which were small, almost disappear when widows and spinsters are excluded in computing the ratios.[13] A major deficiency of this study, due to the manner in which census data were published, was the grouping of castes on the basis of the vocation followed by a *majority* of their members in order to form the above-mentioned occupational groups.

The relation of land ownership to fertility is treated in a report of the National Sample Survey, Government of India. Among women married at least twelve years, the wives of the largest landowners have the highest fertility. But the differences between the groups are small, and the relationship of landownership to fertility is not linear.[14]

The lack of agreement in these studies about the relation of fertility to occupation and income may be interpreted in different ways. It could be attributed, on the one hand, to genuine sectional or regional variations in the relationship, and, on the other hand, to differences in measuring fertility and economic classes.

Objectives and Sources of Data. This paper indicates the average number of children ever born (fertility) to women in central India, classified according to the occupation, income, and landownership of their husbands, and the extent to which their fertility averages are affected by the presence of widows and remarried. Secondly, attention is given to the relation between the fertility averages for unbroken, first marriages in these groups and the age of the female at marriage, the kind of family in which she lives (joint or nuclear), and place of residence.

The averages and percentages presented in this paper are based on careful control of differences among the economic subgroups in duration of marriage. After the women of each subgroup were classified according to the decade in which their marriages occurred, measures were computed for each decade, then cumulated and divided by the number of decades. This procedure is illustrated by Table 1.

Data for this study were obtained through a survey conducted by the author during January–May, 1958 in Nagpur District, which is now politically a part of Bombay State but geographically situated in central India. The sample consists of one per cent of the heads of households in the rural area and in each

[11]N. V. Sovani & K. Dandekar, *Fertility Survey of Nasik, Kolaba, and Satara (North) Districts*, Poona: Gokhale Institute of Politics and Economics, Publication No. 31, 1955, pp. 77-78.

[12]S. P. Jain, *Relationship between Fertility and Economic and Social Status in the Punjab*, Lahore: Punjab Board of Economic Inquiry, Publication No. 64, 1939.

[13]K. Davis, *The Population of India and Pakistan*, Princeton: Princeton University Press, 1951, pp. 74-75.

[14]A. D. Gupta, R. K. Sen, M. Majumdar & S. N. Mitra, *The National Sample Survey, No. 7: Couple Fertility*, New Delhi: Department of Economic Affairs, Ministry of Finance: Government of India, 1955, p. 127.

TABLE 1

MARITAL STATUS AND FERTILITY OF WOMEN, BY DECADES

Period of Marriage	*Frequency of Marital Status*				*Marital Status and Mean Fertility*			
	Unbroken 1st Marr.	Widowed	Remarr.	Total	Unbroken 1st Marr.	Widowed	Remarr.	Total (WM)*
Before 1920	278	53	12	343	6.9	6.5	6.0	6.8
1920-1929	374	27	13	414	6.6	5.0	5.2	6.5
1930-1939	556	16	18	590	5.4	4.5	4.7	5.4
1940-1949	724	—	14	738	3.5	—	2.6	3.5
1950 & later	382	—	2	384	1.4	—	1.0	1.4
Total	2314	96	59	2469	4.7	5.3	3.9	4.7

*WM = Weighted Mean

ward of the city and five towns.[15] The names of the urban dwellers were systematically selected from the National Register of Citizens, and the rural group consists of the residents in twenty-two of the 500 villages in this district. The villages were selected according to geographic location and size, and it is felt that this procedure provides an adequate representation of all rural dwellers. Interviews in Marathi, the language of the area, were conducted by trained interviewers, using a schedule, to gather information on social characteristics and the marital history of the head of the household and his spouse. The 1262 rural and 1327 urban households yielded data on 1429 and 1489 marriages, respectively. In 22 of the rural and 25 of the urban households there was a polygynous marriage involving two to four females living jointly with their spouse. Excluded from this paper are the 213 rural and 236 urban marriages which were broken by the death of the wife.

[15]It was assumed at the beginning of the study that some couples would not be located and that others would not provide the desired information. Therefore, a sample of 1½ per cent of the households was initially drawn with the intent of interviewing until satisfactory data were obtained from one per cent of them. Lack of cooperation on the part of husbands and wives was later found to be a minor problem. The major difficulty of locating certain families was due either to the absence of a number or a double number (municipal and census) for several dwellings. A detailed account of sampling and other methodological procedures and problems in this study will be presented in a forthcoming work, *Differential Fertility in Central India.*

FINDINGS

Occupation and Fertility. Among occupational groups, there is very little difference in fertility.[16] By column 13 of Table 2 we find that artisans, clerks, professionals, and agriculturalists (owners and tenants) have identical averages of 4.8 children. Each of the other two groups—traders and laborers (agricultural and non-agricultural)—have 4.6 children. Other sections of Table 2 indicate the insignificance of widowhood and remarriage as factors affecting general fertility rates among occupations. Although agriculturalists and professionals are identical in fertility, widows constitute 4.3 per cent and remarried 4.1 per cent of the former group but only 1.6 per cent and 0.8 per cent, respectively, of the latter group (columns 7 and 8). Another procedure for measuring the effect of widowhood and remarriage is to compare column 10, which excludes them, with column 13 which includes

[16]One of the major obstructions to accurate measurement of fertility in India is the inability of some women, especially elder ones, to recall their exact number of deliveries. Since the nature and extent of recall lapse is presently unknown, it is impossible to estimate its effect on the fertility averages presented in this paper. For a discussion of this topic, see: Mahalanobis and DasGupta, "The Use of Sample Surveys in Demographic Studies in India," paper presented at the World Population Conference, 1954.

them. Only in the case of the trading group is there a difference in the two fertility averages—a difference which is exceedingly small.

It is also evident from Table 3 that fertility is not related to either the age of the female at marriage, whether she lives in a nuclear or joint family, or resides in an urban or village community. Comparing again agriculturalists and professionals, who are alike in fertility, we find that agriculturalists marry much younger, more frequently live in a joint family, and, as is expected are rural dwellers to a much greater degree.

Income and Fertility. The relationship between income and fertility is presented in Table 4. The group earning 1000–1499 rupees annually have 5.0 children on the average, whereas the two lower and the two upper income groups have averages of 4.7 and 4.8, respectively. When only unbroken, first marriages are considered—a procedure for measuring the effect of widowhood and remarriage on general fertility averages—the averages remain the same except for the 1500–1999 rupee group. In this instance the general average is raised slightly because of the high fertility of widowed women.

Table 5 clearly shows the lack of association between other factors and the fertility of women whose first marriages are unbroken. The four income groups having identical averages of 4.7 children range in age at marriage from 12.3 years to 16.0 years, in joint family living from 24 to 33 per cent, and in urban residence from 32 to 88 per cent. In brief, groups which are identical in fertility show little resemblance in the factors which are thought to affect reproductive patterns.

Land Ownership and Fertility. The lack of a clear-cut relationship between fer-

TABLE 2

OCCUPATION, MARITAL STATUS, AND MEAN FERTILITY IN CENTRAL INDIA

Occupational Group (1)	*Marital Status* — Number				*Marital Status* — Per Cent				*Mean Fertility*			
	Unbroken 1st Marr. (2)	Widowed (3)	Remarr. (4)	Total (5)	Unbroken 1st Marr. (6)	Widowed (7)	Remarr. (8)	Total (9)	Unbroken 1st Marr. (10)	Widowed (11)	Remarr. (12)	Total (WM)* (13)
Laborers	273	17	4	294	92.8	5.8	1.4	100	4.6	4.9	4.8	4.6
Artisans	629	24	16	669	94.0	3.6	2.4	100	4.8	5.7	5.1	4.8
Traders	322	8	8	338	95.3	2.3	2.4	100	4.5	6.1	6.9	4.6
Clerical	202	5	2	209	96.7	2.4	0.9	100	4.8	7.4	1.5	4.8
Professional & Adminis.	248	4	2	254	97.6	1.6	0.8	100	4.8	5.5	1.5	4.8
Agriculturalists	611	29	27	667	91.6	4.3	4.1	100	4.8	4.6	4.0	4.8
Other**	29	9	—	38	76.3	23.7	—	100	4.6	4.3	—	4.5
TOTAL	2314	96	59	2469	93.7	3.9	2.4	100	4.7	5.3	3.9	4.7

* WM = Weighted Mean

** Includes 29 unemployed and 9 who failed to indicate occupation.

TABLE 3

RELATION OF MEAN FERTILITY OF OCCUPATIONAL GROUPS TO AGE AT MARRIAGE, FAMILY STRUCTURE, AND PLACE OF RESIDENCE

Occupational Group	*Mean Fertility*	*Mean Age at Marriage*	*Per Cent Living in Joint Family*	*Per Cent Residing in Urban Area*
Laborers	4.6	13.1	28	39
Artisans	4.8	13.2	28	61
Traders	4.5	14.2	34	70
Clerical	4.8	15.5	17	83
Professional and Adminis.	4.8	15.4	19	67
Agriculturalists	4.8	12.6	40	20
Other	4.6	12.7	38	72
TOTAL	4.7	13.7	31	51

tility and economic status, when measured by the number of acres of land owned, is indicated in Table 6. Large landowners, or those having 20 or more acres, have the highest fertility, 4.9 children on the average, and the small landowners have the lowest, 4.6. But the fertility of both the landless and medium landowners, those having 10-19 acres, exceed that of small landowners. Widowhood and remarriage, as in the case of occupational and income groups, bear little relation to the general fertility of landownership groups. Small and large landowners are most differentiated in fertility, yet 3.6 per cent of the women in each group are widowed, and 3.1 per cent of those in the former and 3.3 per cent of those in the latter are remarried. It is further evident from a comparison of column 10 with column 13 that the inclusion or exclusion of widowed and remarried women in computing fertility averages makes little difference.

Again, one observes by Table 7 a lack of correlation between the reproductive patterns of economic strata and similarities or differences among them in average age at marriage, joint family living, and urban or rural residence. The landless, who have neither a large nor small number of children, have the highest mean age at marriage, the lowest per cent living in a joint family structure, and the highest per cent of urban dwellers.

Birth Control Techniques and Fertility. It is, of course, possible that the fertility averages for our occupational, income, and landownership groups stem from other factors which affect the frequency of their exposure to the risks of pregnancy. Among these are: ignorance of the physiology of reproduction; sterility in either mate; physical incapacitation due to frequent or prolonged illness; physical separation due to the employment situation; the practice of returning to the mother's home for child delivery and postnatal care; or the use of contraceptives and other birth control devices.

The effect of one of these factors may be briefly considered. During the survey, each couple was asked to give information on any birth control techniques which they knew, had used, and the frequency of such use. It is evident from their responses (Table 8) and our data in Table 9 that the low fertility of particular economic groups cannot be attributed to their use of birth control devices. Less than half of the urban couples and only a quarter of the rural ones knew any method—deliberate abstinence, contraceptives, abortion, sterili-

zation—of limiting family size, and only 3.8 per cent of the rural and only 7.3 per cent of the urban couples had employed a technique at any time during their marital life. Of equal significance is the relatively high fertility among couples who had attempted to limit their family size. As Table 9 shows, their mean fertility is 5.1 whereas that of non-users of any technique is only 4.6. This rather unusual situation probably stems from the fact that deliberate controls are not employed until the couple has had an excessive number of children.

Summary. Our data for central India permit the following general conclusions concerning the relation of fertility to economic status. There is little variation in, and in most cases identical, fertility averages among occupational groups. Although fertility is high in the medium income category and in the large landownership group, neither income nor landownership bears a linear relationship to fertility. Differences and similarities among the economic strata in reproductive behavior are not associated with widowhood, remarriage, age of the female at marriage, family structure, or place of residence. Further, deliberate controls are seldom employed to limit family size, and when they are, it appears to occur after a couple has had a large number of children.

Earlier, we noted that the Five-Year Plans and legislation in India are expected to increase the per cent of persons employed in skilled (artisans), clerical and professional occupations; present in the middle-income groups; and owning land. In view of our findings, there is no basis for assuming that changes in the structure of occupations and landownership will, in themselves, alter fertility rates. On the other hand, the expected change in income distribu-

TABLE 4

INCOME, MARITAL STATUS, AND MEAN FERTILITY IN CENTRAL INDIA

Income Group (Rupees) (1)	*Marital Status*								*Mean Fertility*			
	Number				Per Cent							
	Unbroken 1st Marr. (2)	Widowed (3)	Remarr. (4)	Total (5)	Unbroken 1st Marr. (6)	Widowed (7)	Remarr. (8)	Total (9)	Unbroken 1st Marr. (10)	Widowed (11)	Remarr. (12)	Total (WM) • (13)
Under 500	689	42	18	699	91.4	6.0	2.6	100	4.7	4.9	3.3	4.7
500-999	876	23	31	930	94.2	2.5	3.3	100	4.7	5.0	3.9	4.7
1000-1499	356	10	4	370	96.2	2.7	1.1	100	5.0	5.2	7.0	5.0
1500-1999	121	3	3	127	95.2	2.4	2.4	100	4.7	8.3	5.3	4.8
2000 & over	305	5	3	313	97.4	1.6	1.0	100	4.8	6.8	2.5	4.8
Other••	17	13	—	30	56.7	43.3	—	100	4.7	3.8	—	4.3
TOTAL	2314	96	59	2469	93.7	3.9	2.4	100	4.7	5.3	3.9	4.7

• WM = Weighted Mean
•• Indefinite Income.

TABLE 6

LAND OWNERSHIP, MARITAL STATUS, AND MEAN FERTILITY IN CENTRAL INDIA

Land Ownership (in Acres) (1)	*Marital Status* — Number: Unbroken 1st Marr. (2)	Widowed (3)	Remarr. (4)	Total (5)	*Marital Status* — Per Cent: Unbroken 1st Marr. (6)	Widowed (7)	Remarr. (8)	Total (9)	*Mean Fertility*: Unbroken 1st Marr. (10)	Widowed (11)	Remarr. (12)	Total (WM) * (13)
None	1307	41	25	1373	95.2	3.0	1.8	100	4.7	4.5	4.1	4.7
1-9	387	15	13	415	93.3	3.6	3.1	100	4.5	5.6	4.9	4.6
10-19	297	7	10	314	94.6	2.2	3.2	100	4.8	4.0	3.9	4.8
20 and over	309	12	11	332	93.1	3.6	3.3	100	4.9	5.9	4.2	4.9
Other**	14	21	—	35	40.0	60.0	—	100	4.1	5.4	—	4.9
TOTAL	2314	96	59	2469	93.7	3.9	2.4	100	4.7	5.3	3.9	4.7

* WM = Weighted Mean
** Number of acres was not indicated by interviewee.

TABLE 5

RELATION OF MEAN FERTILITY OF INCOME GROUPS TO AGE AT MARRIAGE, FAMILY STRUCTURE, AND PLACE OF RESIDENCE

Income Group (Rupees)	*Mean Fertility*	*Mean Age at Marriage*	*Per Cent Living in Joint Family*	*Per Cent Residing in Urban Area*
Under 500	4.7	12.3	33	32
500-999	4.7	13.0	31	49
1000-1499	5.0	14.1	32	63
1500-1999	4.7	16.0	27	77
2000 & over	4.8	15.6	25	73
Other	4.7	13.4	24	88
TOTAL	4.7	13.7	31	51

tion would most likely produce a slight rise in current rates.

Acknowledgment is due for the support of this research to the Population Council, Inc., the Research Council of the University of Massachusetts, and the U. S. Educational Foundation in India.

TABLE 7

RELATION OF MEAN FERTILITY OF LANDOWNING GROUPS TO AGE AT MARRIAGE, FAMILY STRUCTURE, AND PLACE OF RESIDENCE

Land Ownership (in acres)	*Mean Fertility*	*Mean Age at Marriage*	*Per Cent Living in Joint Family*	*Per Cent Residing in Urban Area*
None	4.7	14.3	26	63
1-9	4.5	13.1	28	33
10-19	4.8	13.4	40	29
20 & over	4.9	13.9	41	38
Other	4.1	14.9	9	56
TOTAL	4.7	13.7	31	51

TABLE 8

PER CENT OF URBAN AND RURAL COUPLES HAVING KNOWLEDGE OF AND USING BIRTH CONTROL TECHNIQUES*

		Knowledge			
		No Knowledge	Non-Use of Techniques	Use of Techniques	Total
Rural	(N = 1106)	74.6	21.6	3.8	100.00
Urban	(N = 1131)	55.9	36.8	7.3	100.00
TOTAL	(N = 2237)	65.2	29.2	5.6	100.00

* Excludes seventeen rural and sixty urban couples who could not or refused to answer the question.

TABLE 9

MEAN NUMBER OF CHILDREN EVER BORN TO RURAL AND URBAN COUPLES, ACCORDING TO USE OR NON-USE OF BIRTH CONTROL TECHNIQUES*

	Mean Number of Children			*Number of Women*		
	Rural	Urban	Total	Rural	Urban	Total
Non-Use	4.7	4.6	4.6	1064	1050	2114
Use	5.0	5.2	5.1	42	81	123
TOTAL	4.7	4.8	4.7	1106	1131	2237

* Excludes seventeen rural and sixty urban couples who could not or refused to answer the question.

EVOLUTION AND THE PHENOMENON OF MAN

HELEN HAMMONS

EVOLUTION DEMANDS OMEGA-GOD. Pierrè Teilhard de Chardin, French Jesuit, biologist and paleontologist, in his posthumously published work, "The Phenomenon of Man," which has been called one of the publishing events of the century, finds God within the scientific evidence for evolution.* He does not fit evolution into a theological framework or otherwise act as an apologist for the supernatural.

With the celebration of the Darwin Centennial still reverberating in the world of science, the publication in English of an exposition like this, whose whole interest is to *see* scientifically, should have impact upon the metaphysical assumptions of much of the thinking about evolution today. More and more, scientists are proclaiming the necessity of directing man's evolution, and eugenists are of this group. The fact that man knows he evolves entails the possibility that he can influence his own biological destiny, many scientists believe. The world of evolution is presented again and again as a world in which man must rely upon himself and realize he is not the darling of the gods but only another aspect of nature. (1) We are told that it is up to us to supply the program which nature has failed to provide. Other scientists find "lofty scientific morality" by the round-about way of psychoanalysis. (2)

Père Teilhard finds direction, program, "scientific morality"—all these—in the very stuff of the universe, and he sees man's task as one of cooperation with what is already part of *rerum natura*. He refuses to dichotomize evolution and the supernatural. For him it is not *sub specie aeternititis* or *sub specie evolutionis*. Both form an unimpeachable whole. Père Teilhard lives in the world Darwin led us to and cannot be said to cling to a belief in Santa Claus. (1) He sees one of the faces of the universe as red in tooth and claw, but he also finds direction in the groping of the evolutionary process. Science and even mankind are marking time at this moment, he believes, because we are reluctant to recognize that evolution has a precise orientation and privileged axis. Leaving aside all anthropocentrism and anthropomorphism, we can see a direction and line of progress for life so well marked, that their reality will universally be admitted by the science of tomorrow, asserts this Jesuit scientist.

Père Teilhard asks us not to expect a final explanation of things or a metaphysical system. What he seeks to depict is not the past in itself but rather as it must appear to an observer standing on the advanced peak where evolution has placed us. It is a safe and modest method, he surmises, and yet suffices to bring surprising visions of the future.

If "The Phenomenon of Man" is to be understood properly, the author insists it must be read not as a work on

*Harper & Brothers, New York, 1959, 318 pp., $5.00.

metaphysics, still less as a sort of theological essay, but purely and simply as a scientific treatise. The following summary, then, of this book is presented only as the attempt of a scientist to *see* and to *show* what happens to man.†

THE STUFF OF THE UNIVERSE

The more we split and pulverize matter artificially, the more insistently it proclaims its fundamental unity. Throughout each new phase of anthroprogenesis we are faced by the unimaginable reality of collective bonds. It is sufficient in the beginning to include them all under the empirical name given by science to their common principle: energy. In its physical, concrete reality the stuff of the universe cannot divide itself. The cosmos in which man finds himself caught up in is a system—a *totum*, a *quantum*; there is an unimpeachable wholeness of its whole. And the more deeply we penetrate into matter the more we are confounded by the interdependence of its parts. All bodies owe their origin to arrangements of a single initial corpuscular type. Matter has obeyed from the beginning that great law of biology, the law of complexification.

THE WITHIN OF THINGS

Père Teilhard believes that on the scientific plane the quarrel between materialists and upholders of a spiritual interpretation of the universe comes from a lack of common ground. Objects are thought of as consisting only of external actions in impermanent relationships or, on the other hand, as being shut in on themselves in their "immanent" working. The two points of view need to be united to take into account the internal as well as the external aspect of things. Things have their Within, their reserve. In the eyes of the physicist nothing exists legitimately except the Without of things. The apparent restriction of the phenomenon of consciousness to higher forms of life has given science an excuse to eliminate it from models of the universe. But Père Teilhard finds a conscious inner face that everywhere duplicates the material external face which alone is commonly considered by science. To avoid an anti-scientific dualism, he describes all energy as physical in nature but divided into two distinct components: a tangential energy linking the element with all others of the same order as itself; a radial energy which draws it toward even greater complexity and centricity—in other words, forward.

THE ADVENT OF LIFE

In a sense we can no more fix an absolute zero in time for the advent of life than for any other experimental reality. Everything has existed from the very first, but to realize that each new being

†Père Teilhard develops his own arrestingly original terminology, some of which is obscure without explanation. Julian Huxley in his introduction to the book offers the following definitions of some of the distinctive terms used. *Complexification:* includes genesis of increasingly elaborate organization during cosmogenesis as manifested in the passage from subatomic units all the way up to cells, then to man and civilized societies; also an all-pervading tendency involving the universe in all its parts in an *enroulement organique sur soi-même*—world stuff as rolled up or folded in upon itself, process being accompanied by increase of energetic tension in the resultant corpuscular organizations, a convergent integration. *Convergence:* used to denote tendency of mankind during its evolution to superpose centripetal on centrifugal trends, so as to prevent centrifugal differentiation from leading to fragmentation and eventually to incorporate the results of differentiation in an organized and unified pattern. *Hominisation:* process by which original proto-human stock became and is becoming more truly human. *Noogenesis:* gradual evolution of mind. *Noosphere:* sphere of mind as opposed to *biosphere* or sphere of life, acting as a transforming agency promoting hominisation.

must have a cosmic embryogenesis in no way invalidates the reality of its historic birth. The best we can say is that life begins with the cell, but the cell cannot be understood unless we situate it on an evolutionary line between a past and a future; it is both the outcome of long preparation and yet profoundly original. The granule of matter is gradually converted into the granule of life. Biochemistry is beginning to establish the reality of molecular aggregates which appear to reduce to measurable proportions the gaping void hitherto supposed to exist between protoplasm and mineral life. What we have then in the cell is really the stuff of the universe reappearing once again with all its characteristics. The first cells must have been formed in a liquid environment out of mega-molecules. It is natural then, that life as it just emerges from matter should be "dripping with molecularity."

Naturalists are more and more convinced that the genesis of life on earth belongs to the category of absolutely unique events that once happened are never repeated. Thus the cellular revolution would be seen as a critical singular point, an unparalleled moment on the curve of telluric evolution; the point of germination. Protoplasm was formed once and only once on earth, thus the deep organic likeness which stamps all living creatures from bacteria to mankind.

THE EXPANSION OF LIFE

Sooner or later each cell divides. The more the phenomenon of cellular division spreads, the more it gains in virulence. Once fission has started, nothing from within can arrest its devouring and creating conflagration. The cell multiplies without crumbling. We find coming into play the endless permutations and combinations of character so dear to modern geneticists. Left alone life would have spread and varied, but always on the same level, like an airplane which can taxi but not take off. Here the phenomenon of additivity intervenes and acts as a vertical component. The rejuvenations made possible by each reproduction achieve something more than mere restitution. They add one to the other, and their sum increases in a predetermined direction. Dispositions are accentuated; organs are adjusted or supplemented. We then get diversification, the apparition of the line as a natural unit distinct from the individual. This law of controlled complication, orthogenesis, Père Teilhard calls the dynamic and only complete form of heredity—the mature stage of the process in which we get first the micro-molecule, then the mega-molecule, and finally the first cells.

Life-fights for elbow room; there is profusion born of unlimited multiplication with a good deal of biological efficiency despite waste. By reckless self-reproduction life takes its precaution against mishap. Here we find the technique of "groping," which combines the blind fantasy of large numbers with precise orientation of a specific target. Groping is seen as directed chance rather than mere chance: pervading everything so as to try everything and trying everything so as to find everything.

As life expands, it splits spontaneously into large units; it ramifies. A dispersion of simple type occurs precisely where chance would make us fear a complicated tangle. The species becomes individualized. The phylum has been born, what Père Teilhard calls the living "bundle," the line of lines. The development of a phylum is strangely parallel to successive stages of man-made invention. Tryout follows tryout; then

at last perfection comes within sight. The newly born group spreads and at the same time consolidates. The final picture presented by a phylum in full bloom is that of a verticil of consolidated forms. Through the technique of groping, it fans out. It enters on mutation. Through the new opening another pulsation of life surges, soon to divide again, and then a new phylum appears; so the process continues.

CONSCIOUSNESS

Père Teilhard finds a direction and line of progress in the phenomenon of consciousness. Among the infinite modalities in which the complication of life is dispersed, the differentiation of nervous tissue stands out as a significant transformation; it provides a direction and by its consequences proves that evolution has a direction. The natural history of living creatures on the exterior amounts to the gradual establishment of a vast nervous system; on the interior it corresponds to the installation of a psychic state on the very dimensions of the earth. On the surface we find nerve fibers and ganglions; deep down, consciousness.

Delving into the Within, we find the phenomenon of a rise of consciousness at the heart of life, explaining its progression. Biologists persist in looking for the principle of vital developments in external stimuli or in statistics. But the impetus of the world, glimpsed in the great drive of consciousness, can only have its ultimate source in some principle which alone could explain its irreversible advance toward higher psychisms. In long-term modifications of the phylum then, we are forced to abandon the explanation of every case simply as survival of the fittest or as a mechanical adaptation to environment and use. We are confronted with an effect not of external forces but of psychology. The number of bones, shape of teeth, ornamentation of the integument: these visible characters merely form the outward garment round something deeper which supports it. To write the true natural history of the world, we need to be able to follow it from *within*. Right at its base the living world is constituted by consciousness clothed in flesh and bone.

The increasing intricacy of forms and organs demonstrates the irreversible augmentation of brain—and therefore consciousness—not only in quantity but quality. Thus we are forced to realize that an event of another order, a metamorphosis, was inevitably awaited to wind up this long period of synthesis in the course of geological time. And this took place in the mammalian layer. Evolution went straight to work on the brain of the primates. In one well-marked region at the heart of the mammals where the most powerful brains are found, they became red-hot. A flame burst forth at a strictly localized point.

Thought is born!

REFLECTION

From a purely positivist point of view man is the most mysterious and disconcerting of all the objects met with by science. As science is able to reconstruct him, he is an animal little separable anatomically from the anthropoids. Morphologically the leap to man was extremely slight; yet it was the concomitant of an incredible commotion among the spheres of life. There is evidence that science neglects an essential factor or rather an entire dimension of the universe. Again it is necessary to consider the Within as well as the Without of things. Biologists do not agree if there is a direction of evolution, nor do psy-

chologists agree whether human psychism differs specifically—by "nature"—from that of man's predecessors. To settle the question of man's superiority over animals, we must make straight for the central phenomenon: reflection.

The animal *knows,* but it cannot *know* that it *knows.* Because we are reflective, we are not only different but quite other. Here in the accession to the power of reflection, the whole curve of biogenesis reappears summed up and clarified. We are disturbed to notice how little *anthropos* differs anatomically from other anthropoids. But is not this resemblance *exactly what had to be?*

By the end of the Tertiary era the psychical temperature of the cellular world had been rising for more than 500 million years. The anthropoid was brought to the boiling point mentally. By a tiny tangential increase, the radial was turned back upon itself, and, so to speak, took an infinite leap forward. Outwardly almost nothing in the organs had changed, but in depth a great revolution has taken place. Consciousness was now leaping and boiling in a space of supersensory relationships and representations.

And all this happened for the first time!

HOMINISATION

Man only progresses by slowly elaborating from age to age the essence and totality of a universe deposited within him. To this grand process of sublimation it is fitting to apply the word *hominisation*: that individual and instantaneous leap from instinct to thought, the progressive phyletic spiritualization of all the forces contained in the animal world. With hominisation we have the beginning of a new age—the era of *noogenesis,* the development of all the stages of the mind. The earth gets a new skin, or better still finds its soul. There is a new layer, the *noosphere,* the thinking layer which has spread over and above the world of plants and animals.

Man came silently into the world!

The human species emerged phyletically like any other, coming from the big primates in the fan of the anthropoids. Each time a new living form rises, it is always complete and already legion. Thus in the eyes of science first man is, and only can be a crowd. He was born a direct lineal descendant from a total effort of life. At the end of the Quarternary era man is modern in every way. In the Neolithic age civilization was born and a cluster of factors favored the pace of hominisation. The noosphere there and then began to close in upon itself and to enrich the earth.

MODERN CHANGE OF NOOSPHERE

Two centuries ago our civilization was based on the soil and its partition. But a critical change of noosphere has taken place since then, and to us in our brief span of life falls the honor of coinciding with it. Life is taking a decisive step in us and in our environment. In the last century and a half the most prodigious event, perhaps, ever recorded by history has been taking place in our minds: the definitive access of consciousness to a scale of new dimensions, and the birth of an entirely renewed universe without any change of line or feature by the simple transformation of its intimate substance.

What makes and classifies a modern man is his seeing in terms, not of space and time alone, but of duration, or biological space-time; and, above all, having become incapable of seeing anything otherwise—anything—not even himself. Evolution is now, whether we like it or

not, gaining the psychic zones of the world and transferring to the spiritual constructions of life not only the cosmic stuff but also the cosmic "primacy" hitherto reserved by science to the tangled whirlwind of the ancient "ether." The consciousness of each of us is evolution looking at itself. Man is not the center of consciousness as once thought but something much more wonderful: the arrow pointing to the final unification of the world in terms of life.

But this vision only acquires its full value through the simultaneous illumination within ourselves of the laws and conditions of heredity. We do not yet know how characters are formed, accumulated, and transmitted in the secret recesses of the germ cells. Biology inclines to make the living being the passive and powerless witness of the transformation he undergoes. In our innermost being we all feel the weight of obscure powers—good or bad—a sort of definite and unalterable *quantum* handed down once and for all from the past. But with no less clarity we see that the further advance of the vital wave depends on how industriously we use these powers.

Transplanted by man into the thinking layer of the earth, heredity without ceasing to be germinal (or chromosomatic) in the individual finds itself, by its very life center, settled in a reflecting organism, collective and permanent, in which phylogenesis merges with ontogenesis. From the chain of cells it passes into the circumterrestrial layers of the noosphere. Passive as it may have been before reflection, heredity now springs to life supremely active in its noospheric form, that is to say, by becoming hominised. It is not enough to say that evolution, by becoming conscious of itself in the depths of ourselves, only needs to look at itself to perceive itself. It also becomes free to dispose of itself; it can give or refuse itself. Not only do we read in our slightest acts the secret of its proceedings, but, for an elementary part, we hold it in our hands, responsible for its past to its future.

The whole psychology of modern disquiet is linked with the sudden confrontation with space-time. The malady of "space-time" manifests itself by a feeling of futility, of being crushed by the enormities of the cosmos. Enormity of space is the most tangible and frightening aspect. We need the perception of an evolution animating these dimensions of multitude and immensity. Time and space become humanised as soon as a definite movement appears which gives them a physiognomy. Half our present uneasiness would turn into happiness if we could accept the facts and place our modern cosmogonies within a noogenesis. What makes our world specifically modern is our discovery in it and around it of evolution. What disconcerts our modern world at its very roots is not being sure of an outcome—a suitable outcome—to that evolution.

MEGA-SYNTHESIS

The spring and secret of hominisation is found in the coalescence of elements and the coalescence of stems — the spherical geometry of the earth and psychical curvature of the mind harmonizing to counterbalance the individual and collective forces of dispersion in the world and to impose unification. By this unification there is a general gathering together in which, by correlated actions of the Without and the Within of the earth, the totality of thinking units and forces are engaged. All this becomes intelligible as the natural culmination of a cosmic process which has never varied

since our planet was young. First molecules of carbon compounds with their thousands of atoms symmetrically grouped, next the cell containing thousands of molecules, then the metazoa in which the cell is no more than an almost infinitestimal element, and later the manifold attempts of the metazoa to enter into symbiosis and raise themselves to a higher biological condition. And now, as a germination of planetary dimensions, comes the thinking layer which intertwines its fibers to reinforce them in the living unity of a single tissue. Père Teilhard sees no way of grouping this immense succession of facts save as a gigantic psychobiologic operation, a sort of mega-synthesis: that superarrangement to which all the thinking elements of the earth find themselves subject today.

If this is what really happens, what more do we need to convince ourselves of the vital error of any doctrine of isolation? asks Père Teilhard. No element could move and grow except with and by all the others with itself. No evolutionary future therefore awaits man except in association with all other men. Within the compass of biological space-time, man is a continuation of the very lines of the universe amongst other realities as vast as itself.

With our knowledge of hormones we are on the eve of having a hand in the development of our bodies and even our brains. With the discovery of genes we soon may be able to control the mechanism of organic heredity. And research fosters the dream of mastering, beyond all atomic or molecular affinities, the ultimate energy of the world, and, thus, by grasping the very mainspring of evolution, seizing the tiller of the world. But there is less difference than we think between research and adoration. For knowledge in the end always faces the same problem: how to give to each and every element its final value by grouping them in the unity of an organized whole.

COLLECTIVITY OF CONSCIOUSNESSES AND THE HYPER-PERSONAL

We are faced with a harmonized collectivity of consciousnesses, equivalent to a sort of super-consciousness. Père Teilhard sees the earth as being covered by myriads of grains of thought and becoming enclosed in a single thinking envelope to form the plurality of individual reflections which are the act of a single unanimous reflection. Thus we are led scientifically to envisage the future of mankind. To the man in the street and even to a certain philosophy of the world, perspectives such as these will seem highly improbable. But to a mind familiar with the fantastic dimensions of the universe, they will seem quite natural. In the direction of thought, could the universe terminate with anything less than the measureless?

The idea of a spirit of the earth does not stand up to the test of experience. Man will never succeed in going beyond man by uniting with himself. But Père Teilhard feels that discouragement is a feeling to be overcome. Half a million, perhaps a million, years were required for life to pass from the pre-hominids to modern man. Thus, despite an almost explosive acceleration of noogenesis, we cannot expect to see the earth transformed in a generation. In spite of all evidence to the contrary, mankind may well be advancing, but, if so, almost imperceptibly. And this does not allay the most acute of our fears: Does it not seem sometimes as though we were in the grip of some ineluctable forces of mutual repulsion and materialization?

Is it not possible, asks Père Teilhard, that we have neglected to give due place to the person and forces of personalization? Unlike primitives who gave a face to every moving thing, modern man is obsessed by the need to depersonalize all he most admires. Personality is seen as a specifically corpuscular and ephemeral property, a prison from which we must try to escape. Yet we seem to be led to the precisely opposite view by notions of space-time and evolution.

What is the nature of the personal center of convergence upon whose existence hangs the evolutionary equilibrium of the noosphere? By definition, in Omega the hoard of consciousness liberated little by little on earth by noogenesis adds itself together and accumulates. The very center of our consciousness, deeper than all its radii: that is the essence which Omega—if it is truly to be Omega—must reclaim. The grains of consciousness do not tend to blend; the more "other" they become in conjunction, the more they find themselves as "self," steeped in Omega. Omega can only be a distinct center radiating at the core of a system of centers. This is the only picture that emerges when we try to apply the idea of collectivity with remorseless logic to a granular whole of thoughts. The goal of ourselves is not our individuality but our person, and according to the evolutionary structure of the world we can only find our person by uniting. The true ego then grows in inverse proportion to egoism. Amongst the various forms of psychic inter-activity animating the noosphere, those of an intercentric nature must be harnessed first, if we want to help the process of evolution in ourselves. This brings us to the problem of love.

CONVERGENCE IN OMEGA

Considered in its full biological reality, love is not peculiar to man. If there were no internal propensity to unite—even at a prodigiously rudimentary level, indeed in the molecule itself—it would be physically impossible for love to appear higher up in hominised form. Driven by the forces of love, the fragments of the world seek each other so that the world may come to being. This is no metaphor. Love is nothing more and nothing less than the more or less direct trace marked on the heart of the element by the psychical convergence of the universe upon itself. The paradoxical conciliation of the element with the whole, the synthesis of individuals and people: these are called Utopian, and yet they are biologically necessary. We may think we have exhausted the natural forms of love with a man's love for his wife, children, friends, or country. Yet the most fundamental form of passion is the one which under the pressure of an involuting universe precipitates the elements one upon the other in the Whole: cosmic affinity and hence cosmic direction. A universal love thus is not only psychologically possible; it is the only complete and final way in which we are able to love.

For failure to turn into success, we should extend our science to its farthest limits and accept not only some vague future existence but also the radiation, as a present reality, of that mysterious center of centers, Omega. Thus from the grains of thought forming the indestructible atoms of its stuff, the universe goes on building itself above our heads in the inverse direction of matter which vanishes. For Omega is the hominisation of death itself. The universe then is a collector and conservator, not of mechanical energy, but of persons. All around

us "souls" break away, carrying upward their incommunicable load of consciousness—one by one, yet not in isolation. By the very nature of Omega, for each of them there can only be one possible point of definitive emersion—that point at which, under the synthesizing action of personalizing union, the noosphere will reach collectively its point of convergence, at the "end of the world."

RESEARCH IN EUGENICS

Père Teilhard gives eugenic research new dimensions in terms of evolutionary process. Along what lines of advance are we to proceed, he asks, from the planetary level of psychic totalization and evolutionary upsurge we are now approaching? If research is to progress, it will be by localizing central zones for conquest. An era of human science is in order, the practical and theoretical science of hominisation.

> "So far we have certainly allowed our race to develop at random, and we have given too little thought to the question of what medical and moral factors must replace the crude forces of natural selection should we suppress them. In the course of the coming centuries it is indispensable that a nobly human form of eugenics, on a standard worthy of our personalities, should be discovered and developed.
> "Whether we like it or not, all the signs and all our needs converge in the same direction. We need and are irresistibly being led to create, by means of and beyond all physics, all biology and all psychology, a science of human energetics.
> "It is in the course of that creation, already obscurely begun, that science, by being led to concentrate on man, will find itself increasingly face to face with religion."

Science and religion must join, for neither has succeeded in discrediting the other. And the reason is simple. The same life animates both. Religion and science are the two conjugated faces of one and the same act of complete knowledge—the only one which can embrace the past and future of evolution.

THE CHRISTIAN PHENOMENON

By its very structure the noosphere could not close itself, either individually or socially, save under the influence of the Center called Omega. We are led logically to this postulate by the application to man of the experimental laws of evolution. If Omega is already in existence, its traces should be manifested here. To animate evolution in its lower stages, the conscious pole of the world could only act in an impersonal form under the veil of biology. Either the whole construction of the world as presented here is vain ideology, suggests Père Teilhard, or some excess of personal, extra-human energy should reveal the Great Presence. At this point we see the importance for science of the Christian phenomenon. It seems to bring to the perspectives of a universe dominated by energies of a personal nature the crucial confirmation we need.

Christianity seems desperately intricate. In reality it contains an extremely simple and astonishingly bold solution of the world. Is the Kingdom of God a big family? Yes, in a sense, says Père Teilhard. In another sense it is a prodigious biological operation: that of the Redeeming Incarnation. As early as St. Paul and St. John we read that God unifies the world by uniting it organically with himself, by partially immersing himself in things, by becoming "element," and then from this point of vantage in the heart of matter assuming the control of what we now call evolution. Christ, principle of universal vitality, put himself in the position to subdue

under himself, to purify, to direct and superanimate the general ascent of consciousness into which he inserted himself. By a perennial act of communion and sublimation, he aggregates to himself the total psychism of the earth. And when he has gathered together and transformed everything, he will close in upon himself and his conquests, thereby rejoining the divine focus he has never left. The universe fulfills itself in a synthesis of centers in perfect conformity with the laws of union: God, the Center of centers. In that final vision the Christian dogma culminates, and this coincides perfectly with the Omega Point.

The bigger the world becomes and the more organic its internal connections, the more will the perspectives of the Incarnation triumph. Though frightened for a moment by evolution, the Christian now perceives that what it offers him is nothing but a magnificent means of feeling more at one with God and giving himself more to Him. Christ invests himself organically with the very majesty of his creation. It is in no way metaphorical to say that man finds himself capable of experiencing his God in the whole length, breadth, and depth of the world in movement. To be able to say literally to God that one loves him not only with all one's body, heart, and soul but with every fiber of the unifying universe: this is a prayer that can only be made in space-time.

CONCLUSIONS

Père Teilhard went against much of the thinking of his own Church with this majestic presentation of evolution and the phenomenon of man. He was barred from teaching in France because of his ideas on human evolution, and he never obtained permission to publish any of his major works. Many scientists would decry his metaphysics and say: "We don't know;" or "The evidence is lacking." As Julian Huxley states in his introduction to this volume, many will find it impossible to follow him all the way in his attempt to reconcile the supernatural elements in Christianity with the facts and implications of evolution. Other scientists will find some of his material inadequate. Huxley points out that the biologist may think he has slighted genetics and natural selection and the social scientist that he has neglected political and social history. But his purpose was not to review all the "evidence." Who could? Père Teilhard was impatient of overspecialization and the timidity which refuses to pass from detailed study to broad synthesis. To open up rather than to finalize, is his stated aim. This he certainly accomplishes, regardless of how strongly one may dissent from his position; and he does it in language noteworthy for its simplicity although sometimes obscure in meaning, and with a synthesis of concepts awesome in their totality.

His final summation of human evolution will not be found wanting, at least:

> "In one manner or another it still remains true that, even in the view of the mere biologist, the human epic resembles nothing so much as a way of the Cross."

REFERENCES

1. Simpson, George G. 1960. The world into which Darwin led us. *Science*, **131**:966-974.
2. Rostand, Jean. 1959. *Can Man be Modified?* New York: Basic Books.

A Proposed Standard System of Nomenclature Of Human Mitotic Chromosomes

The rapid growth of knowledge of human chromosomes in several laboratories, following advances in technical methods, has given rise to several systems by which the chromosomes are named. This has led to confusion in the literature and so to the need for resolving the differences. Consequently, at the suggestions of Dr. C. E. Ford, a small study group was convened to attempt the formulation of a common system of nomenclature. The meeting was arranged, through Dr. T. T. Puck, to be held in April, 1960, at the University of Colorado, under auspices of the Medical School. The meeting of this study group was made possible by the support of the American Cancer Society, to whom grateful thanks are due. For practical reasons, it was decided to keep the group as small as possible and to limit it to those human cytologists who had already published karyotypes.* In addition, three counselors were invited to join the group to guide and aid the discussions and, if necessary, to arbitrate. Fortunately, the last office did not prove necessary, and it was possible by mutual agreement to arrive at a common system which had flexibility.

*In contemporary publications the terms, karyotype and idiogram, have often been used indiscriminately. We would recommend that the term, *karyotype*, should be applied to a systematized array of the chromosomes of a single cell prepared either by drawing or by photography, with the extension in meaning that the chromosomes of a single cell can typify the chromosomes of an individual or even a species. The term, *idiogram*, would then be reserved for the diagrammatic representation of a karyotype, which may be based on measurements of the chromosomes in several or many cells.

It was agreed that the principles to be observed by the system should be simplicity and freedom, as far as possible, from ambiguity and risks of confusion, especially with other systems of nomenclature in human genetics. It should also be capable of adjustment and expansion to meet the need of new knowledge of human chromosomes. The system should be agreed to by the greatest possible proportion of cytologists working in the field, but the risk that a minority may be unable to accept the system as a whole should not be allowed to delay adoption by a majority.

It was agreed that the autosomes should be serially numbered, 1 to 22, as nearly as possible in descending order of length, consistent with operational conveniences of identification by other criteria. The sex chromosomes should continue to be referred to as X and Y, rather than by a number, which would be an additional, and ultimately, a superfluous appellation.

It was generally agreed that the 22 autosomes can be classified into seven groups, distinction between which can readily be made. Within these groups, further identification of individual chromosomes can in many cases be made relatively easy. Within some groups, especially the group of chromosomes numbered 6-12, including also the X chromosome, the distinctions between the chromosomes are very difficult to make by presently available criteria. However, lesser difficulties are encountered in separating chromosomes 6 and the X from the remainder of this group. It is believed that, with very favorable preparations, distinction can be made

between most, if not all, chromosomes.

It is proposed that the autosomes first be ordered by placing the seven groups as nearly as possible in descending order of size. Within each group the chromosomes are arranged, for the most part, by size. It was desired specifically to avoid the implication that size relationships have been permanently decided in every instance, but it is hoped that the assignment of numbers will be permanently fixed. In those cases where distinction is at present doubtful, final definition of each chromosome can be left until further knowledge has accrued, though an attempt is made to provide a characterization of each. These principles make it possible to draw up a conspectus of the chromosomes, a table of their quantitative characteristics and a table of the synonyms which authors have already published. These are appended (Tables I, II and III).

In Table II, showing the diagnostic characters of the chromosomes, three parameters are relied upon. These are: (1) The length of each chromosome relative to the total length of a normal, X-containing, haploid set, i.e., the sum of the lengths of the 22 autosomes and of the X chromosome, expressed per thousand; (2) The arm ratio of the chromosomes expressed as the length of the longer arm relative to the shorter one; and (3) The centromeric index expressed as the ratio of the length of the shorter arm to the whole length of the chromosome. The two latter indices are, of course, related algebraically quite simply, but it is thought useful to present both here. In some chromosomes, the additional criterion of the presence of a satellite is available (Table I), but in view of the apparent morphological variation of satellites they and their connecting strands are excluded in computing the indices.

Table II shows the range of measurements determined by various workers. Some of the variation expresses the uncertainty due to measurement of relatively small objects; but many of the discrepancies between different workers' observations are due to the measurement of chromosomes at different stages of mitosis and to the effect of different methods of pretreatment and preparation for microscopic study. The ranges shown, therefore, represent the maxima and minima of the means found by different workers using different techniques. However, within any one worker's observations, the variations are not so broad.

Reference should be made to two other matters of nomenclature. In the first place, it is considered that no sepa-

TABLE I

CONSPECTUS OF HUMAN MITOTIC CHROMOSOMES

Group 1–3	Large chromosomes with approximately median centromeres. The three chromosomes are readily distinguished from each other by size and centromere position.
Group 4–5	Large chromosomes with submedian centromeres. The two chromosomes are difficult to distinguish, but chromosome 4 is slightly longer.
Group 6–12	Medium sized chromosomes with submedian centromeres. The X chromosome resembles the longer chromosomes in this group, especially chromosome 6, from which it is difficult to distinguish. This large group is the one which presents major difficulty in identification of individual chromosomes.
Group 13–15	Medium sized chromosomes with nearly terminal centromeres ("acrocentric" chromosomes). Chromosome 13 has a prominent satellite on the short arm. Chromosome 14 has a small satellite on the short arm. No satellite has been detected on chromosome 15.
Group 16–18	Rather short chromosomes with approximately median (in chromosome 16) or submedian centromeres.
Group 19–20	Short chromosomes with approximately median centromeres.
Group 21–22	Very short, acrocentric chromosomes. Chromosome 21 has a satellite on its short arm. The Y chromosome is similar to these chromosomes.

TABLE II

QUANTITATIVE CHARACTERISTICS OF THE HUMAN MITOTIC CHROMOSOMES

All measurements were made from cells of normal individuals, except those made by Fraccaro and Lindsten, which included cases of Turner's Syndrome. The column A is the relative length of each chromosome, B is the arm ratio and C the centromere index, as defined in the text.

	Tjio and Puck (6)			Chu and Giles (2)			Levan and Hsu (5)			Fraccaro and Lindsten*			Lejeune and Turpin (4) *			Buckton, Jacobs and Harnden*			Range		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
1	90	1.1	48	90	1.1	48	85	1.1	49	82	1.1	48	87	1.1	48	83	1.1	48	82–90	1.1	48–49
2	82	1.6	39	83	1.5	40	79	1.6	38	77	1.5	40	84	1.5	40	79	1.6	38	77–84	1.5–1.6	38–40
3	70	1.2	45	72	1.2	46	69	1.2	45	65	1.2	45	67	1.2	46	63	1.2	46	63–72	1.2	45–46
4	64	2.9	26	63	2.9	26	63	2.7	27	62	2.6	28	62	2.6	25	60	2.6	28	60–64	2.6–2.9	25–28
5	58	3.2	24	58	3.2	24	59	2.6	28	60	2.4	29	57	2.4	30	57	2.4	30	57–60	2.4–3.2	24–30
X	59	1.9	34	57	2.8	48	52	1.6	38	54	1.6	38	58	2.2	32	51	1.7	37	51–59	1.6–2.8	32–38
6	55	1.7	37	56	1.8	36	56	1.7	37	54	1.6	38	56	1.7	37	56	1.6	38	54–56	1.6–1.8	36–38
7	47	1.3	43	52	1.9	35	51	1.9	35	50	1.7	37	51	1.8	36	50	1.7	37	47–52	1.3–1.9	35–43
8	44	1.5	29	46	1.7	29	48	1.6	33	47	1.7	37	48	2.4	29	46	1.5	40	44–48	1.5–2.4	29–40
9	44	1.9	40	46	2.4	38	47	1.8	36	45	2.0	33	47	1.9	35	44	2.1	32	44–47	1.8–2.4	32–40
10	43	2.4	27	45	2.3	30	45	2.0	33	45	2.6	34	45	2.6	27	44	1.9	35	43–45	1.9–2.6	27–35
11	43	2.8	34	44	2.1	32	44	2.2	31	43	2.2	31	44	1.6	39	43	1.5	40	43–44	1.5–2.8	31–40
12	42	3.1	24	43	3.1	24	42	1.7	32	43	1.7	37	42	2.8	27	42	2.1	32	42–43	1.7–3.1	24–37
13	35	8.0	11	32	9.7	10	32	5.0	16	34	4.8	17	33	6.8	14	36	4.9	17	32–36	4.8–9.7	10–17
14	32	7.3	12	34	9.5	9	37	4.0	18	35	4.4	19	32	7.0	13	34	4.3	19	32–37	4.3–9.5	9–19
15	29	10.5	9	31	11.9	8	35	4.7	17	33	4.6	22	31	10.0	9	34	3.8	22	29–35	3.8–11.9	8–22
16	32	1.8	36	27	1.6	38	30	1.4	42	31	1.4	42	29	1.4	41	33	1.4	31	27–33	1.4–1.8	31–42
17	29	2.8	26	30	2.1	33	29	2.4	30	30	1.9	35	29	3.1	23	30	1.8	36	29–30	1.8–3.1	23–36
18	24	3.8	21	25	3.8	22	25	2.6	28	27	2.5	29	26	4.2	21	27	2.4	29	24–27	2.4–4.2	21–29
19	22	1.4	41	22	1.9	34	24	1.2	40	25	1.3	43	22	1.4	42	26	1.2	45	22–26	1.2–1.9	34–45
20	21	1.3	44	19	1.3	44	21	1.2	40	23	1.3	43	20	1.2	43	25	1.2	46	19–25	1.2–1.3	40–46
21	18	3.7	21	15	6.8	13	13	2.5	28	19	2.5	29	15	2.3	31	20	2.5	29	13–20	2.3–6.8	13–31
22	17	3.3	23	12	6.0	14	16	2.0	33	17	2.3	30	13	4.0	20	18	2.7	27	12–18	2.0–6.0	14–33
Y	19	∞	0	11	∞	0	18	4.9	17	22	2.9	26	18	∞	0	18	4.9	17	11–22	2.9–∞	0–26

*Unpublished data.

TABLE III

SYNONYMY OF CHROMOSOMES AS PUBLISHED BY VARIOUS WORKERS

New Chromosome Number	Tjio and Puck (6)	Chu and Giles (2)	Levan and Hsu (5)	Ford Jacobs and Lajtha (3)	Böök Fraccaro and Lindsten (1)	Lejeune, Turpin and Gautier (4)
1	1	1	1	1	1	G1
2	2	2	2	2	2	G2
3	3	3	3	3	3	G3
4	4	4	4	4	4	G4
5	5	5	5	5	5	G5
6	6	6	6	6*	6	M1
7	7	7	7	(8)	7	M2
8	8	8	8	(9)	8	Md1
9	9	9	9	(11)	9	M3
10	10	10	10	10	10	Md2
11	11	11	11	(12)	11	M4
12	12	12	12	(13)	12	Md3
13	18	14	20	14	14	T1
14	19	15	18	15	15	T2
15	20	13	19	16	13	T3
16	13	17	15	19	16	C1
17	14	16	13	17	17	P1
18	15	18	14	18	18	P2
19	16	19	16	20	19	C2
20	17	20	17	21	20	C3
21	21	21	22	22	21	Vh
22	22	22	21	23	22	Vs
X	X	X	X	?(7)	X	X
Y	Y	Y	Y	Y	Y	Y

*In the published idiogram the chromosomes of group 6–12 (including X) were indicated by discontinuous lines and left unnumbered owing to the uncertainty of discrimination at that time. For the purpose of this table, these chromosomes have been assigned the numbers shown in brackets, in serial order of length.

rate nomenclature for the groups is needed. It is considered that any group to which it may be necessary to refer will be a sequence of those designated by Arabic numerals. Hence, any chromosome group may be referred to by the Arabic numerals of the extreme chromosomes of the group, joined together by a hyphen, e.g., the group of the three longest chromosomes would be Group 1-3. This scheme has the merit of great flexibility. For instance, chromosomes X and 6 may be separated from the Group 6-12 whenever they can be distinguished.

Secondly, there is the problem raised by the abnormal chromosomes which are being encountered in the more recent studies. Their nomenclature was discussed without a definite conclusion being reached. Broadly, it was agreed, however, that any symbol used should avoid incorporating a specific interpretation which was not reasonably established. It was suggested that arbitrary symbols, prefixed by a designation of the laboratory of origin, should usually be assigned to the abnormal chromosome.

In this connection, two further requisites for coordination of research were discussed. One is the storage of documentation for reference, perhaps in a central depository, additional to what it may be possible to publish. The other

is the desirability that cultures be preserved, by the satisfactory methods now used, so that they are available for reference, comparison and exchange.

Some consideration was also given to the desirability of using a uniform system for presenting karyotypes and idiograms, but, recognizing that individual variation in taste is involved, rigidity of design was thought undesirable. However, it was recommended that the chromosomes should be arranged in numerical order, with the sex chromosomes near to but separated from the autosomes they resemble. It is desirable that similar ones be grouped together with their centromeres aligned.

It is recognized that choice between the different possible schemes of nomenclature is arbitrary, but that uniformity for ease of reference is essential. Hence, individual preferences have been subordinated to the common good in reaching this agreement. This human chromosomes study group therefore agrees to use this notation and recommends that any who prefer to use any other scheme should, at the same time, also refer to the standard system proposed here.

We are well aware of the wide interest in the work of this study group and realize that this meeting is merely a preliminary to a larger meeting. It is believed that two needs have to be met in this respect. One is for seminars and workshops at which workers in the field may exchange information; such seminars are best arranged regionally. The second need, which may come later, is for international conferences; and we believe that congresses and other organizations whose interests include human genetics, should promote such meetings.

REFERENCES

1. Böök, J. A., Fraccaro, M., Lindsten, J., Cytogenetical Observations in Mongolism, *Acta Paediatrica*. **48**: 453, 1959.
2. Chu, E. H. Y., and Giles, N. H. Human Chromosome Complements in Normal Somatic Cells in Culture, *Am. J. Hu. Genetics*, **11**: 63-79, 1959.
3. Ford, C. E., Jacobs, P. A. and Lajtha, L., Human Somatic Chromosome, *Nature*, **181**: 1565, 1958.
4. Lejeune, J., Turpin, R. and Gautier, M., Le Mongolisme, premier exemple d'aberration Autosomique Humaine, *Ann. Génét.*, **2**: 41-49, 1959.
5. Levan, A. and Hsu, T. C., The Human Idiogram, *Hereditas*, **45**: 665-672, 1959.
6. Tjio, J. H. and Puck, T. T., The Somatic Chromosomes of Man, *Proc. Nat. Acad. Sci.*, **44**: 1229-1237, 1958.

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Book Reviews

HUMAN BIOCHEMICAL GENETICS: H. Harris. Cambridge University Press, 1959, 310 pp., $7.00.

It is indeed a pleasure to note the appearance of Dr. Harris' volume on "Human Genetics." In the six years since the completion of his previous monograph, "An Introduction to Human Biochemical Genetics," which was published as part of the Memoir Series of the Eugenics Laboratory, the field has truly come of age. Rapid progress in our knowledge of biochemistry has made the "inborn errors of metabolism" no longer matters to be viewed as scientific curiosities but of practical importance to the practicing physician. Dr. Harris' book represents a summary of the advances as seen from the viewpoint of a human geneticist.

The present volume has been completely rewritten. It includes many of the exciting new developments in the field such as the identification of specific enzyme defects, sequential analysis of amino acids in the hemoglobinopathies, and the hereditary variations of the various plasma proteins. He leaves out certain sections such as variation in taste to phenylthiourea and touches only slightly on β-aminoisobutyric acid excretion, both of which were extensively discussed in his previous monograph. This illustrates that human biochemical genetics have progressed to such an extent that these less specific markers need no longer be considered in great detail. Dr. Harris starts off with two introductory chapters discussing such fundamental concepts as Mendelian hereditary and biochemical individuality, and concludes with an excellent section on current thinking on gene action and how it might fit in with the Watson-Crick hypothesis. In between, he takes up the problems on amino acid metabolism, carbohydrate metabolism, the hemoglobins, the blood group substances, the plasma proteins, and some miscellaneous inherited disorders of metabolism.

The book is an excellent one for the student of human genetics. It not only gives a thorough review of the subject but presents Dr. Harris' personal philosophy and thinking in the field, which has extended over many years. His mathematical treatment of data and their significance is simple and yet complete. He has a good grasp of the biochemical literature and emphasizes the important and pertinent findings. It is pleasing that he has chosen to include such human physiological variations as the haptoglobins and the blood group substances as well as disease processes of a hereditary nature. He has been particularly clever in introducing the difficult concept of balanced polymorphism at the end of the section of the human hemoglobins and the role of modifying genes following a discussion on the blood group substances.

From the viewpoint of the physician, the book tends to be somewhat uneven. Dr. Harris is at his best in the conditions where he has been personally instrumental in gathering much of the available data, namely, cystinuria, hypophosphatasia, and some of the newer amino-aciduria. Here he has an actual feeling for the disease process from the bedside of the patient. On the other hand, he has

passed over in a sketchy fashion many of the other important conditions such as the defects of coagulation and has chosen to omit altogether any discussion on the lipid disturbances and cystic fibrosis of the pancreas. The latter is particularly serious since it probably represents one of the four or five most common clinical conditions seen among the "inborn errors of metabolism."

It would also have been useful if Dr. Harris had discussed certain general concepts which may ultimately prove to be of importance to biochemical genetics. Some mention should be made on the possible relation between biochemical changes and structural defects of a hereditary nature during embryogenesis. The role of development of enzyme systems during early infancy and its possible genetic significance in terms of hereditary variation should be discussed. The book touches only briefly on the explanation of two modes of inheritance involving the same chemical phenomena such as in alkaptonuria and on two different clinical patterns with the same metabolic defect such as in glucose-6-phosphate dehydrogenase deficiency in individuals with primaquine sensitivity and in those hereditary nonspherocytic hemolytic anemia. Finally, certain other variations between normal individuals such as those described by Williams should be included briefly.

One could also take issue with a few specific details. On page 81 there is mention of the swan-like neck in the glomerulus of the nephrons in the Fanconi syndrome. There is doubt as to whether this is a late manifestation of the pathological process and whether this is specific for this syndrome. On page 104, a milder form of von Gierke's disease due to glucose-6-phosphatase deficiency is described. One wonders if these may not represent one of the newer genetic entities with glycogen storage. On page 112, mention is made that no inhibitors are present in the galactose-1-phosphate uridyl transferase system in galactosemia. Recent evidence indicates that glucose-6-phosphate dehydrogenase may be rate limiting if not inhibitive in that pathway.

These are minor defects in what will undoubtedly be the definitive work in this new and important field. Dr. Harris is to be thanked for giving us this volume.

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An Introduction To Medical Genetics: J. A. Fraser Roberts, Oxford University, London, 1959, 263 pp.

This concise and informative introduction to medical genetics appears at an opportune time when many physicians, stimulated by discoveries in hematology and metabolic disorders, attempt to acquaint themselves with the principles of genetics and their application to questions of human medicine. The book, which developed from courses of lectures for medical students, can be used by physicians or students who have no previous knowledge of genetics. The first chapters deal with the physical basis of inheritance, with dominant, recessive, intermediate and sex-linked transmission, with multiple allelomorphs and chromosomal rearrangements. A special chapter is devoted to the genetics of the blood groups, a topic which is of great theoretical and practical interest to geneticists as well as physicians. The principles of linkage and crossing-over are explained and illustrated by examples of human traits and disorders. The chapter entitled "The Gene in Action" is of particular importance to

the medical reader. It emphasizes that many genes manifest themselves not as specifically as the genes responsible for the hemoglobins and the blood groups. The actions of many genes may be modified by numerous factors so that their end results appear often variable and lacking strict specificity. It is pointed out that a pleiotropic gene can produce manifold effects and that, on the other hand, clinically similar effects can be caused by different genes. A section is devoted to environmental influences which may simulate the actions of genes and produce results comparable to those effected by genes. Consequently genetic entities and clinical entities must be clearly differentiated. Variable expressivity and penetrance, modifying genes, sex-limited inheritance, and interaction of genes are briefly discussed. Human variation, multifactorial inheritance, and common diseases are the subject of another section. The last chapter, devoted to genetic prognosis and advice, is brief, cautious and sound. Giving genetic advice must be accepted as an art, though an art founded on scientific principles. The proportion of people who need genetic advice is fairly small, but those who need it should get it from a qualified person rather than from other sources. It seems that the majority of couples fear that the outlook is much worse than it really is. It is not the task to advise patients whether or not they should have children but to give them an explanation of the chances so that they can make up their own minds. The author believes, possibly somewhat optimistically, that most parents understand answers and explanations given in terms of odds. If the risk to be taken is compared to the chance of any random pregnancy ending with a serious congenital malformation, the parents are often greatly relieved by the relative favorable prognosis of their own case. A complete assurance that there is no chance of recurrence of anomalies is of course unwise and unfounded. Even deafness following rubella in early pregnancy could be due occasionally to a recessive gene, the maternal disease being coincidental. A satisfactory genetic prognosis must be based on correct diagnosis, family history and knowledge of the literature. Examples are cited of advice in cases of dominant, sex-linked or recessive transmission. Problems arising from alternative modes of transmission and from cousin marriage are discussed. The value of empirical risk figures for conditions of obscure genetics is acknowledged, but it is pointed out correctly that attempts should be made to distinguish different risks for subgroups of the disorder whenever possible.

This book is, as its title indicates, an introduction to medical genetics. It presents admirably the principles of genetics and their application to problems of human genetics. It cites many disorders of genetic origin as examples in order to illustrate the basic laws, their modifications and exceptions. However, the reader must not expect to find a complete list of diseases and disorders with a genetic background in this small volume. Such a list of disorders with their modes of inheritance has been purposely omitted, since it was felt that such a presentation would be necessarily incomplete and dogmatic. Yet this book will be very useful to many physicians and medical students as a sound introduction to medical genetics.

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OUTLINE OF HUMAN GENETICS: L. S. Penrose. John Wiley, New York, 1959, 146 pp.

The basic facts and principles of human genetics are here covered in 146 pages. Since the book is approximately pocket size, this is short order, indeed. Penrose, however, is expert in the subject and discriminating in his exposition of it.

The introductory explanation of early theories of inheritance and the modern view stemming from Mendel is unusually adroit, and the reader with no background in genetics will be able to appreciate the historical growth of genetical concepts without being dragged through all the details of early theories. The succeeding chapters are: Single Gene Effects, Genes and Populations, Association and Linkage, Interplay of Environment and Heredity, and Eugenics and Dysgenics.

The scheme of genetic equilibrium for intelligence which Penrose presents in the eugenics chapter will be of special interest to readers of this journal. He shows that under certain assumptions the superior fertility of the less intelligent would not result in a decline in average intelligence. This is a good point to understand. Although his scheme is admittedly oversimplified and some of the assumptions perhaps unrealistic, it does show that the problem of the genetic consequences of differential fertility is not so simple as might be assumed.

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GENETIK DES MENSCHEN—LEHRBUCH DER HUMANGENETIK: Otmar F. v. Verschuer. Urban & Schwarzenberg, Munich, 1959, 427 pp., 48 D.M.

Professor von Verschuer has given us a book in the Fischer-Bauer-Lenz tradition. The primary concern is with gross morphological and psychological inheritance.

Maximum space is devoted to descriptive material of malformations due to dominant inheritance and to the discussion of psychiatric phenomena, whose hereditary aspects remain relatively unknown. It is, perhaps, a pity that so little space is allotted to some of the more recently developed fields of biochemical and hematological genetics.

Discussion of methodology is primarily confined to twin studies, which are stressed throughout the book. It might have been desirable to include some warning of the theoretical pitfalls open to the inexperienced twin investigator.

The last chapter, entitled Application of Human Genetics, is a good summary of present problems and activities in the field but also contains some comments which appear to favor some forms of negative eugenics.

In summary, it seems unfortunate that this valuable collection of rare morphological diseases is not really a general and complete "Textbook of Human Genetics" as is stated in the subtitle.

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CANCER IN FAMILIES. A STUDY OF THE RELATIVES OF 200 BREAST CANCER PROBANDS: Douglas P. Murphy and Helen Abbey. 1959, Harvard University Press, Cambridge. 76 pp. $2.50.

This monograph constitutes a companion to the senior author's "Heredity in Uterine Cancer" (1952). The methodology of the two studies was extremely similar, but the newer results have not

been related to those of the previous work.

In essence, this volume is a lengthy paper of a type that is well suited to publication in a journal. The major result of its appearance in book form is to call attention to its findings and to attract criticism of its techniques (as through the publication of reviews). In this instance, the material does not warrant the attention that it will receive.

The authors report that they have not found evidence for a different rate of cancer or of breast cancer in the families of women with breast cancer, as compared with families of control women. Unfortunately, this study, though obviously carefully carried out, was neither well planned nor well analyzed. Therefore, its conclusions are not of great importance to an understanding of the problems attacked.

In the study of a common condition, it is a major fault in planning to include persons who are not closely related. Sixty per cent of the population analyzed are first cousins and aunts and uncles by marriage of the probands. The authors have failed to observe that a first cousin has only a quarter as much common heredity with a proband as is carried by a parent or sib. Thus, enlarging the number of families investigated would amply have repaid the effort, in contrast to the strenuous task of digging up long-lost first cousins. The analysis has greatly erred in lumping information about these uninformative first cousins with the precious data for sibs. Worse yet, the data for parents and their sibs have been obfuscated by the inclusion of the information about aunts and uncles by marriage!

The observed rates of breast cancer are low, and the numbers in the informative categories are small. The mothers and sisters of the parents of breast cancer probands show a higher rate of this disease than the same relatives of the controls. The sisters of the probands do not show this trend, and the information that might be of interest (age distribution, number of children, etc.) is not available. The only other major observation is that there are no differences in the frequency of all cancers between the two classes of families.

The care used in compiling this volume cannot mitigate the effects of a poor distribution of effort. It is doubtful that some of the extensive tables can ever be of use to anyone, and the information that other studies have indicated should be available will have to be requested from the authors privately if these data are to be reanalyzed.

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BABIES BY CHOICE OR CHANCE: Alan F. Guttmacher, M.D. Doubleday, Garden City, New York, 1959, 000 pp., $0.00.

"This is an indignant book!" are the first words of the first chapter. It is a book addressed to everyone who cares for mankind and believes that we owe something to our descendants. To this reviewer, however, Dr. Alan F. Guttmacher speaks with temperance and reason. He is a scientist of excellent repute and a practitioner of the art of medicine whose feeling for each patient is as deep as his conscience is strong when it comes to larger social issues. His book reflects these qualities and is suitable for both doctor and layman.

Birth control is an issue of importance to the individual as well as to human

beings as a species, and yet the subject, Dr. Guttmacher feels, is greeted with too much apathy. He says "the apathy of the people can be excused on the grounds of ignorance, but it is difficult to understand why governments in possession of the facts are either incredibly myopic, or seemingly in a state of fatalistic acquiescence."

It is impossible to remain apathetic after reading "Babies by Choice or by Chance." The simplest arithmetic shows that mankind has interfered with natural law through scientific medicine and public health to the extent that a true explosion "even more catastrophic than atomic bombs" is upon us. One can satisfy himself on this point by noting what will happen in the United States alone if the present excess of births over deaths continues. Approaching the figures slightly differently from the way Dr. Guttmacher does, let us examine the consequences of our present rate of increase. Our nation is now adding to itself at a net rate which will result in a doubling of population in forty years. Four such doublings would encompass only 160 years, a period of time about one generation less than has elapsed since the Declaration of Independence. Four doublings of 180 million result in the figure of 2.88 billion, which is slightly more than the total world population at the present moment. Even in a shorter period of time, the dignity of the individual will surely have been lost, as it has been in China, and "privacy, the privilege of being alone to contemplate will be a legendary pleasure of the historic past." In this short time, our country will be so filled with people that such projects as camping in the open by boy scouts and others will be as impossible as it is now in Central Park in New York.

Obviously, no such overcrowding will actually take place. There will either be an increase in deaths (by war, famine or disease) or a decrease in births. Dr. Guttmacher's book is both a plea for birth control and a consideration of what it means to the individual and to the family. He believes it offers a solution to our problems which large segments of our population have already adopted with wisdom and dignity. If others do the same, the catastrophies of war, famine and disease can be avoided.

The rhythm method of scheduled abstinence from sexual contact has been shown to be theoretically valid but, people being what they are, and subject to natural law, completely incapable of actually controlling p o p u l a t i o n overgrowth. The most effective method at present is the use of some sort of mechanical barrier between sperm and ovum. Such methods can be effective in prosperous countries, but "when daily income is totaled in cents, and not dollars, spending even a few pennies for a contraceptive becomes a financial impossibility." Only the active support of contraception by the government can possibly result in effective control of over-population. A program for population control has been undertaken in Japan. One has been attempted with little success, so far, in India. In China, a population control campaign has apparently been abruptly terminated for unknown but no doubt ominous reasons. The continued resistance of many, but by no means all, churches and governments is puzzling. Dr. Guttmacher says: "I think the simplest explanation of the widespread religious and political concern over curtailment of full reproductive capacity is in terms of more and more parishioners, more and more soldiers and workers."

In terms of technique, rather than philosophy, it seems that the only method which could curtail population would be "the pill." Such pills have been developed and tried to a small extent. Their safety and efficacy are not yet known with certainty. Upon the development of such a pill, and upon its acceptance by religious hierarchies and governments depend the future of the world.

Does widespread knowledge of birth control technics expose us to the danger of race suicide? Dr. Guttmacher thinks not. He says that there is such knowledge today in many countries, and it is used, he feels, wisely. For example, ". . . the moderate-sized family is on the way up, the very large family on the way down. To me this is irrefutable evidence of planned pregnancies and an excellent answer to the opponents of birth control who view its use as synonymous with race suicide."

Abortion is a method of birth control which is abhorrent to us but which has been widely practiced in times past, in some cultures today, and clandestinely today in every Christian nation, despite the opposition of government and religion. The problem is complex. The position taken by Scandinavian countries is intermediate between the laxity in Japan and the strictness of the U.S., though in this country each state has its own laws. Neither Shintoism nor Buddhism forbid abortion, which may account for the fact that the Japanese make less of a distinction between abortion and contraception than do we. The Scandinavians permit abortion for medical reasons, for social reasons (too many children in a family), for eugenic purposes (to prevent the perpetuation of certain hereditary diseases) and for humanistic reasons, such as in the case of pregnancy resulting from rape and incest. In this country, the various state laws are a "jumble of contradictions, inconsistencies and frustrations." As a result, the illegal abortion business thrives. Who can disagree with Dr. Guttmacher when he says "It is high time that a commission of physicians, lawyers, judges, sociologists and religionists convened in an attempt to wrestle with the problem realistically." "What I want from each pregnancy is a sound mother and a healthy, happy child raised in a good environment. But I am strongly opposed to modifying the law to permit abortion on demand. There must be important medical or sociological necessity."

Dr. Guttmacher also considers infertility and its cause and treatment. When there is no medical solution to sterility, either adoption or artificial insemination provide an answer for some couples. Here, again, the oppression of organized society exerts itself against the well-being and happiness of the family. The supply of suitable babies for adoption is small, so that a black market thrives. Religious scruples about insemination, as well as psychological troubles arising from the unequal role of the parents in producing such children, make for unhappiness. Dr. Guttmacher's discussion is wise and kindly and should be read by those who face these problems personally.

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FAMILY PLANNING, STERILITY, AND POPULATION GROWTH: Ronald Freedman, Pascal K. Whelpton, and Arthur A. Campbell. McGraw-Hill Book Co., New York, 1959, 515 pp., $9.50.

Concerning this book one can hardly restrain an "At last!" Despite sustained popular and scientific concern with

problems of population growth and human fertility in this country for the past few decades, there has never before been any adequate information on the population's attitudes and practices with respect to family planning. For the first time a representative sampling of American families has been taken, covering such topics as preferred and expected number of children, fertility impairments, contraceptive practices and the differential effectiveness of such practices. Due to the adequacy of the sample, it is now possible to discuss these variables in the light of variations in religious, educational, residential, and occupational characteristics. Indeed, the only major limitations of the sample are its exclusion of males and the colored population—gaps which will undoubtedly be filled in the near future.

Probably one of the major reasons for the tardiness of such a study has been the fear that the average citizen could not be asked such presumably intimate questions. The present study dispels such fears. Unlike the Indianapolis and Kinsey studies which used specialized staff for interviewing, the present survey used routine survey interviewers. Nevertheless, only five per cent of the women contacted refused to be interviewed, a rate lower than expected for any kind of national survey. The reviewer's similar experiences with fertility surveys in other countries suggest that it is time to bury the taboos on employment of polling techniques for "intimate" topics. There are both *a priori* and empirical grounds for believing that women feel more competent and comfortable discussing sex than national issues.

The study reaches important conclusions concerning the extent and implications of fertility impairments (widespread but not very important in determining population trends); the incidence of family planning (83 per cent among fecund couples); the impact of socio-economic variables on fertility values and behavior (differences are disappearing, but education is far more important than income, residence or occupation); and national population trends (about 312 million by year 2000). Some of the most interesting findings, however, relate to religious differentials. A few salient points are summarized below:

1. *Attitudes*: Only one per cent of the Protestants and 13 per cent of the Catholics expressed unqualified disapproval of family limitation, while 72 per cent of the former and 33 per cent of the latter expressed complete approval. Religion rather than socio-economic characteristics appears to account for the differential attitudes. Indeed, among Catholics there is some evidence of a negative relation between favorable attitudes and socio-economic status.

2. *Birth Control*: Among fecund Catholic wives, 70 per cent have used some method to avoid conception, and an additional 10 per cent plan to use a method. The lower incidence of family planning among Catholics is not explained by education, residence, income or occupation. As age increases, differences by religion diminish, but as education increases the differences are increased. Among working women, Catholic-Protestant differentials virtually disappear. Although close to half of the Catholic users have employed appliance methods, two-thirds report having used rhythm (as opposed to a quarter of the Prostestant users). Among all fecund Catholic couples married ten years or more, half have used a method other than rhythm.

3. *Fertility*: Although the total number of births is about the same for both

religious groups (partly because Catholics marry a year and a half later than Prostestants), Catholic wives *expect* to have 17 per cent more births than do Protestants. On the other hand, there is evidence that with age the Catholic women revise their preferred number downward. On the whole, differences in completed family size are likely to be small.

At least one important finding seems questionable—the low incidence of withdrawal. Only 11 per cent of the entire sample and only a fifth of the grade school ever-users reported this method. I suspect that the way in which the question was asked may have led to underreporting, especially among women of grade school education.

The authors show a high degree of craftsmanship in presenting the fairly complex findings. Tables illustrating negative findings and detailed cross-tabulations are made available in mimeographed form; quotations from respondents and interviewers are used judiciously to illustrate and enliven statistical findings; pertinent literature is summarized in an appendix; chapter and other summaries are frequent; percentages are rounded to the nearest whole number; and the text is uncluttered with tests of significance—these can easily be derived from appendix tables. The book could serve as a model for presentation of survey data.

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Human Potentialities: Gardner Murphy, Basic Books, Inc., New York, 1958. 340 pp.

As Gardner Murphy points out, Alexander the Great of Macedon wept because he thought there were no more lands to conquer. In regard to the horizons of human nature, Dr. Murphy suffers from no such myopia. In this lies perhaps the major virtue and fault of his book.

"Human Potentialities" represents an attempt to describe the present situation in which Man finds himself, the possibilities in him for change and broad ways of encouraging such changes. Murphy finds in Man three natures, one simian, one cultural, and one creative. In a kind of dialectic, the first two tend to work against the third. That is to say, both biology and society tend to rigidify and crystallize thought and behavior and thus diminish the Promethian thrust Man possesses in his third nature.

The fact Man is a primate means he is cast in a mold of primate ways. How would a Marsupial man have behaved? The fact he lives in a society and occupies a role defined by that society similarly limits him. By creativity, however, Man can break out of these molds and seek to define himself in a multitude of ways, some as yet never envisioned. History can be transcended in a synthesis between these three natures. Not extrapolative but emergent thinking is needed.

In broad outline, this is the major theme of the book and, as such, it is entirely admirable. When it comes to specifics, however, the book seems to me to labor somewhat. It is certainly a good thing to free ourselves from prejudice, to be flexible, curious and creative. And it is also probably true that these important qualities can be fostered by society in its members. How this can be done is not so easily answered. I think perhaps Murphy gives so many answers that the cogency of each becomes seriously diminished. Thus in Chapter 13 on Biological Changes in Man, he suggests attack on such problems as the genetic effects of homogamy, mutations, the effects of radi-

ation, the inheritance of psychological traits such as self-control, emotional stability, and curiosity, the nature and effects of overpopulation and a number of others. In other chapters, we find much the same kind of proliferation of solutions. Murphy seems to me to show an almost existentialist wonder at the number of new natures Man can have and the number of ways of achieving them. As I indicated already this feature of the book is both good and bad.

It is bad in the sense that the reader (especially the scientific one) who is interested in really getting down to brass tacks will find the book a rather bewildering array of genetic, psychological, philosophical and sociological discussions, few of them dealt with at a level concrete enough to be very convincing. Indeed, it is my feeling that Dr. Murphy is too friendly to too many ideas. For example, we find him lauding at one point, the "lonely thinker," the individualist who strives to build his own essence. And on the other hand, we find elsewhere a strong plea for man becoming "part of the cosmos." It is a little startling to find Sartre and Hegel packaged together so neatly.

This broad eclecticism of the book is good, on the other hand, in that it should make intelligent lay readers or those scientists with interests peripheral to the subject become aware of the importance of the problem and the great diversity of lines of attack on it that can be taken. From this standpoint, the book may do a good deal for the welfare of the behavioral sciences.

Dr. Murphy has written many other books and articles on a good number of different topics and is an experienced writer. "Human Potentialities" is thus quite readable, though there are parts where the style (and thought) becomes rather lush and turgid. For example,

> "It is likely . . . that the tiny child, long before he can verbalize, resonates to cosmic patterns with a deep sense that is basically he himself; long before there is a socially defined self he senses a rhythm, a dynamic pattern in the world which he senses in an isomorphic form within himself. To the rhythms and cadences of sounds about him, he makes a re-echoing response through his own limbs and his own vocalizations, not through an instinct of imitation, but because he is of the same stuff as the world (p. 299)."

Personally, I find this rather rich for my blood, though the point made may be an interesting one. There are many other passages like this one sprinkled through the book, so it is not atypical.

How such a book will appeal to the readers of *Eugenics Quarterly* is difficult to say. Some will like it a great deal, some not at all. But I would say that it should be viewed in the right perspective—a perspective that focuses the reader's view not so much on answers to the problems that face Man today but on the questions that can be asked about these problems. Those who read it in this way will find it rewarding.

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Adam's Brood: Colin Bertram. Preface by Julian Huxley. Peter Davies, London, 1959, 223 pp., 21s.

Colin Bertram, biologist, naturalist, explorer, and officer of the Eugenics Society across the waters, has written what may aptly be called (in two senses) a good, old-fashioned book. He presents a biologist's view of the world's problems. A sampling will give the flavor. Of population: "all too many breed." Of social maladjustment: "ulcers, like the Chinaman's long fingernails of the

past, are but the honorable mark of the busy and successful gentleman." Of scholarship: "are not sunshine and scholarliness antagonistic, as are family life and scholarliness most certainly today?" Of solitude: "It is a horrifying thought that the world contains already over a thousand million people who have never in their whole lives been solitary." Of success: "is the species with the largest bio-mass to be regarded as the most successful?" Of justice: "let us recognize that the world is a most unfair place. People are by no means born equal."

Spiritually, Bertram's book shows kinship with both Thoreau and Gilbert White. It is a sort of "Natural History of Selborne" with the County of Southampton extended over the whole globe, and natural phenomena focused by man's interest. Travel notes, anthropological photos, and ethical questions are interlaced in a pattern that is not altogether obvious. The leisurely reader should enjoy it; the busy man—remember that Nietzsche said that the very busy man seldom changes his opinions—will no doubt find "Adam's Brood" simply irritating.

Although most biologists will agree with most of Bertram's statements, a few exceptionable passages should be noted. On p. 65 he says: "The time for effective legislative treatment of wanton useless noise has surely come; noxious smells and the pollution of the atmosphere have been progressively controlled." Can the resident of smog-bound Los Angeles agree to that? And what about London? (And fallout?) Two pages later he asserts that successful suicides outnumber road accidents. I am unable to lay my hands on English statistics, but I note that in the U.S., auto accidents are 2.5 times as common as suicides. Finally, let me quote, without comment, what is probably the most controversial passage of all (pp. 201-202).

> "But when my neighbor and myself are of different colour, different smell and different shape—genetically quite a lot, not just a little different—and our food habits, marital habits and traditions are greatly at variance, then there is real potential antagonism between us. Now here is the point. I believe this antagonism to be deep-seated and fundamental; to be in us the equivalent of the factors which hold apart the developing biological races of other fast-evolving species; to be, in origin and in fact, a protector (by the common distaste for intermarriage) of the biological (or racial) groups to which we personally happen to belong. Clearly man is a very fast-evolving species: until modern transport came, the splitting into geographical races was proceeding rapidly. This I hold not to be a matter in the realms of right and wrong but of biological fact. Where wrongness arrives, I believe, is when perfectly natural and biologically-rooted antagonisms are equated with sin. To do so nurtures conflict (being based on untruth) and certainly does not solve it."

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Notes on Recent Publications

L'Age Atomique et Notre Avenir Biologique (Collection—Evolution des Sciences): H. V. Brønsted. Masson et Cie, Paris, 1959, 90 pp., 850 fr.

Discusses the risks to humanity emerging from the use of atomic energy with a minimum of technical language. Such topics are covered as radiation, mutations, sterility, embryonic development, and isotopes. The author, who specializes in embryology and genetics at the University of Copenhagen, is concerned chiefly with arousing awareness of our responsibility for the genetic future of the human race.

The Condom As a Contraceptive: Christopher Tietze, M.D., National Committee on Maternal Health, New York, 1960, 44 pp.

The condom may prove to be a highly acceptable and effective method of contraception in many parts of the world, concludes the author of this study. Too little attention has been paid to the condom as a measure of population control in the belief that it is expensive, unreliable and less acceptable to couples. Dr. Tietze finds however, that the condom can be produced at reasonable cost and high standards assured. It is not only a widely used method of birth control, but the rate of change to other methods tends to be lower than for other contraceptives. As used by married couples in a variety of situations, it offers greater protection than most other methods employed by these groups.

Natural Selection In Human Populations: Edited by D. F. Roberts and G. A. Harrison. Pergamon Press, New York, 1959, 76 pp., $3.00. (Symposia of the Society of Human Biology, Vol. II)

Papers from a symposium held in 1958 by the newly formed Society for the Study of Human Biology. L. S. Penrose reviews natural selection in man, suggesting fields for investigation. A. R. G. Owen describes mathematical models for selection, and C. A. Clarke discusses relative fitness of human mutant genes. Other topics include natural selection and some polymorphic characters in man (P. M. Sheppard), selection of gene systems in natural populations (T. Dobzhansky), and the rate of change in primate evolution (E. H. Ashton).

Introduction to Quantitative Genetics: D. S. Falconer. Ronald Press, New York, 1960, 360 pp., $6.00.

An introductory textbook on quantitative genetics which can be understood by biologists with ordinary mathematical ability, according to the author. The general principles of the field are given and its application to animal or plant breeding. Emphasis is chiefly on the theoretical side, and the experimental side is presented mainly in the form of examples. The author concludes that some of the outstanding problems are beyond the reach of present experimental techniques and that new techniques will have to be developed. Other problems arise from the scarcity of experimental data and will be solved by the accumulated experience of a wider variety of experiments.

Essential Tremor—A Clinical and Genetic Population Study: Tage Larsson and Torsten Sjögren. Munksgaard, Copenhagen, 1960, 176 pp.

A population investigation of 210 cases of essential tremor in Sweden. All 210 cases have lines of ascent to one or more of nine ancestral couples, and the authors find that all these cases can be explained (with two exceptions) by dominant heredity from four of these couples. The heredity must be autosomal. Essential tremor in this study was found to have a comparatively late onset and slow progress. Clinical examination was made of 81 cases and information obtained about the rest.

Many of the results of this study are probably of general validity, the authors conclude. No methodical clinical investigation of sufficiently large and representative essential tremor series has been undertaken previously, nor any genetic study of such population material carried out before, they state.

RETINAL DEGENERATION COMBINED WITH OBESITY, DIABETES MELLITUS, AND NEUROGENEOUS DISEASES: C. H. Alström, B. Hallgren, L. B. Nilsson, H. Asander. Munksgaard, Copenhagen, 1959, 35 pp. (*Acta Psychiatrica et Neurologica*, Supplementum 129, Vol. 34, 1959)

A clinical, endicronological and genetic examination based on a large pedigree of a specific syndrome which is distinct from the Laurence-Moon-Bardet-Biedl Syndrome. It deals with three cases in two related families. Affected individuals and their relatives were examined and the families traced genealogically. The genetic analysis indicates that the separate symptoms are manifestations of a recessive mutation in a single gene locus, and that this syndrome represents a genetic and clinical entity not previously described.

POPULATION—The First Essay: Thomas R. Malthus (Foreword by Kenneth E. Boulding). Ann Arbor Paperbacks, University of Michigan Press, 1959, 139 pp., $1.75.

The foreword points out aspects of this classic essay on population which could not have been apparent to its readers upon its publication some 160 years ago. It is the harbinger of the Darwinian revolution in man's image of nature and himself. And we now have the opportunity to look backward on Malthusian prophecies. The author of the foreword suggests that the "Dismal Theorem" can be restated in moderately cheerful form: If something other than misery and starvation can be found to keep a prosperous population in check, the population does not have to grow until it starves and it can be stably prosperous. We know a lot more about the mathematics of population than Malthus, he states, but very little more about its sociology, as shown by the failures of the population experts in predicting the postwar population of the United States.

Malthus is still worth reading and has important lessons for us today, the foreword concludes. This compact, well-designed paperback edition makes this essay readily available.

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Periodical Reviews

GENETICS

Incidence of Diabetes Mellitus in the Burtha-Buthe District of Basutoland. W. M. Politzer, B. Hardegger, and T. Schneider. *British Medical Journal,* 5173 (1960), 615-616.

Diabetes mellitus has been established as a genetic disease although investigators have not always agreed on the nature of the genetic mechanism involved. Steinberg and Wilder (*Am. J. Human Genet.,* 4 (1952), pp. 113-135) have concluded that the published data are compatible with the hypothesis of a recessive form of inheritance, with the genotype concerned only leading to a clinical case about 20 per cent of the time. If so, it is important to determine how this group differs from the other 80 per cent with the predisposing genotype in regard to exogenous and other endogamous factors.

The authors point out that the suggestion has been made several times in the literature that the incidence of diabetes is lower in communities in which primitive conditions prevail, such as certain areas of Africa. This is of interest since available data show that the American Negro is just as susceptible to diabetes as the white.

In order to obtain data on the incidence of diabetes and glycosuria in a primitive community in Africa, the authors ran a survey on three-thousand individuals attending the out-patient ward of a hospital. None were known to have diabetes. These individuals came to the hospital for some other ailment, or merely accompanied patients. The individuals varied in age from 20 to 85 years. Twelve (3 males, 9 females) showed glycosuria, but none had symptoms of clinical diabetes. The incidence was 0.05 per cent for the under-40 group, and 0.55 per cent for the above-40 age group. Since it is estimated that in the United States, 1.7 per cent of the population has diabetes mellitus, it is evident that the Basuto population has a low incidence.

This Basuto population, in general, exists on a low-calorie diet consisting mainly of carbohydrates. This evidence, plus similar evidence from other areas in the world, suggests, therefore, that one of the stimulating factors which interacts with the genetic component and brings on clinical diabetes, is a high proportion of fats in the diet.

Mongoloide Idiotie bei Mutter und zwei Kindern aus Inzesten. E. Hanhart. *A. Ge. Me. Ge.,* 9 (1960), pp. 112-129.

The cases of mongolian idiocy that have been studied all show a trisomic condition of the smallest autosome. Individuals with this defect have 47 chromosomes, instead of the normal diploid number of 46.

No case has been reported in the literature where a male mongoloid has produced any offspring, but reproduction by female mongoloids is known. It would be expected that these females would produce two kinds of eggs. Because of the triplo condition of the smallest autosome, during synapsis of the chromosomes in meiosis, all three could come together, or two would pair and one would remain unpaired. Under either

condition, at the first meiotic division, two chromosomes would normally migrate to one pole and one would go to the other pole. Theoretically, one-half of the eggs should have the normal number of chromosomes and one-half should have the $n + 1$ number. This theoretical expectation might not be achieved, since evidence from other trisomic organisms shows, especially for small cromosomes, that unpaired extra chromosomes may lag in cell division and become lost, resulting in a preponderance of gametes with the normal chromosome number. From the cytogenetic picture, it would be expected, however, that a fertile mongoloid would produce mongoloid and nonmongoloid offspring.

The author presents a unique pedigree showing a case where a mongoloid female produced two children—both mongoloid. The father of the children is suspected to be the brother of the mother. No cytological studies were completed on these individuals.

From a survey of the world literature, the author concludes that this is the first reported case of two mongoloid children being born to a mongoloid mother, and the sixth reported case of mongolism occurring in mother and child.

Upper End of Range of Intelligence in Mongolism. M. I. Dunsdon, C. O. Carter, R. M. C. Huntley. *Lancet*, 1 (1960), 565-568.

The authors state that it is yet to be proven that all mongoloids have the trisomic condition of the smallest autosome in all their cells. Perhaps some are partial mongoloids, with some cells having 47 chromosomes and some 46, and some may show a chromosomal aberration whereas only part of the smallest autosome is duplicated. This might explain why some mongoloids are less mentally retarded than others.

The authors carried out a study in London to obtain information on the upper end of the range of intelligence in mongols and to determine if these mentally high-grade mongols varied from mentally low-grade mongols in respect to ATD angles on the palm prints: a characteristic of mongols that can be expressed quantitatively.

From a large series of mongols who had attended the Hospital for Sick Children, in London, a selection was made for those who attended schools, or appeared to be relatively bright upon interview. Tests were run on 44 of these "mentally high grade" mongoloids. The Terman-Merril intelligence quotient ranged from 19 to 68 for these individuals. The authors conclude, therefore, that extreme variation exists among mongoloids in regard to IQ and that a mongoloid may have an IQ value as high as 70.

The authors then showed that 20 mongoloids with an IQ of 45 or more were essentially no different for palm print measurements (ATD angles) than mongoloids with a lower IQ. Thus, mongoloids that are "more normal" for IQ are not "more normal" for ATD angles on the palm prints.

Anencephaly and Other Congenital Abnormalities—an Epidemiological Study in Northhamptonshire. M. J. Pleydell. *British Medical Journal*, 5169 (1960), 309-315.

In recent years there has been an increased interest in the etiology of congenital malformations. Genetics and illness of the mother during pregnancy have been implicated, but for the majority of cases the causative factors are unknown.

In order to evaluate the influence of

maternal illness, the author made an epidemiological study of congenital abnormalities that have occurred in Northamptonshire since 1944. It was noted that the incidence of defects of the central nervous system, in general, was higher for urban than rural areas, and that anencephaly was three times as common in the industrial belt as elsewhere in the country. Although the data are scanty, there was an unusual grouping of cases in some years, and in certain localities, that did not seem to be due to chance. For example, of the mothers who gave birth to anencephalics in 1957, two of them were living on adjacent streets during their pregnancies. Two other mothers who lived on one of these streets during their pregnancy gave birth to defective children in 1958—one case an anencephalic and the other a hydrocephalic. These observations, plus the impression that anencephaly is more common among persons in the lower income groups with large families, leads the author to conclude that infectious diseases affecting mothers during the early stages of pregnancy are an important cause of anencephaly and other abnormalities.

Coffey and Jessop (*Lancet*, 7109 (1959) pp. 935-138), from a prospective study based on 600 mothers, have concluded that influenza is an important agent for malformation, especially anencephaly. The author presents supporting data from a similar but smaller prospective study carried out in Northamptonshire.

The author stresses that if the correlation between maternal illness during pregnancy and congenital defect can be substantiated, steps can be taken, through preventive medicine, to decrease the incidence of these disorders.

Since geneticists are often called upon to give counseling advise for congenital malformations, the results of epidemiological studies such as these are of prime importance.

Concordance of Smoking Habits in Monozygotic and Dizygotic twins. G. F. Todd and J. I. Mason. *Heredity*, 13 (1959), 417-444.

In order to investigate the influence genetics has on smoking habits, the authors extended the work begun by R. A. Fisher on twins. Three different groups of monozygotic and dizygotic twins from different areas were investigated by the questionnaire method, either by mail or personal interview. Each person was queried about his smoking habits at that time and in the past. The analysis was based on 52 monozygotic and 32 dizygotic pairs of twins.

Several different definitions of a smoker were used, and regardless of which definition was used, concordance for smoking habit was found more frequently for the monozygotic twins than the dizygotic twins. The conclusion is, therefore, that smoking habit has a genetic component.

Potential Genetic Variability of Wild Pairs of *Drosophila melanogaster*. R. Milkman. *Science*, 131 (1960), 225-226.

The importance of polygenes for the occurrence of congenital malformations in man is unknown. On the basis of genetic experiments with animals, the evidence is highly suggestive that this type of genetic mechanism may be of etiological importance for some types of malformations. Lerner, in his book, "Genetic Homeostasis" (John Wiley & Sons, New York, 1954) has proposed that Mendelian populations, through

mutation pressure and selection for the heterozygote, build up polygenic systems that have a buffering effect in development. Homozygosity for some of these polygenes leads to an increased risk that an individual will have a defect which Lerner calls a phenodeviant. This thesis proposes that populations are polymorphic for normal individuals and phenodeviants, and that the occurrence of phenodeviants in the population is the price that the population pays for its adaptiveness.

In order to demonstrate the potential genetic variability found in *Drosophila melanogaster*, the author collected 21 wild, inseminated females from grocery stores in Ann Arbor, Michigan. The offspring from these flies were then inbred, resulting in 21 different F_2 populations. One thousand flies from each population were then examined individually for a defective posterior crossvein. This phenodeviant is due to polygenes found on all three major chromosomes. Eleven of the 21 F_2 populations showed at least one of these phenodeviants.

This demonstration of the genetic variability found in wild type flies, leading to the production of phenodeviants, is of great concern to the human geneticist interested in the causative factors of congenital malformations.

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POPULATION

Birth Control and Public Policy. Kingsley Davis and Judith Blake. *Commentary* **29**, 2 (February 1960), 115-121.

The authors present a provocative discussion of the birth control controversy which began with recommendations by advisory bodies that the federal government facilitate the adoption of birth control in underdeveloped areas, and with a subsequent public statement by the Roman Catholic bishops of the United States opposing "any public assistance, either at home or abroad, to promote artificial birth prevention." Davis and Blake's article is not easy to review, for not only is it polemical in tone (which is certainly permissible), but some of the points are made partly by implication. The authors' central argument includes the following contentions:

1. The bishops' values are not necessarily shared, in practice, by the bulk of Roman Catholic laymen. Survey data show that interest in family limitation is widespread among American Catholic couples, and when the rhythm method proves unsatisfactory, they tend to resort to methods of birth control disapproved by the Catholic clergy.

2. The bishops' contention that migration and economic development provide satisfactory substitutes for birth control in attacking the problem of poverty in densely settled agrarian regions is not valid, since (a) the people of such regions desire higher levels of welfare, not just more people living at minimum levels of subsistence, and (b) successful economic development requires income above the subsistence level, which is incompatible with unlimited growth of population.

3. The "no compulsion" theme elaborated by some political figures in commenting on proposals that the U. S. government facilitate birth control abroad is irrelevant, since there is evidence that the desire for family limitation is already present and growing.

4. Therefore, the bishops' remedies for

underdeveloped areas are not adequate and the problem of coercion is spurious. The real political obstacle to adoption of a government policy involving a balanced program of both economic development *and* birth control is not the opposition of the mass of Catholics but the mistaken notion that the bishops are their political spokesmen on this issue. However, "the current debate in the United States over birth control is more important for this country than for the people of Japan, India, and many other 'backward' lands, who will doubtless pursue their population programs whether we help or oppose them." The real danger is that this issue will prove divisive at home. This can be avoided "if Catholic laymen continue to form their own opinions and restrain the clergy from seeking to force church doctrine into law and public policy—at the same time that other religious groups do likewise."

This reviewer believes that Davis and Blake have neglected to document a crucial link in what he judges to be their line of argument. They implicitly assume that any failure of individual Catholics to conform to church teaching on birth control implies a rejection of the moral validity of that teaching as a guide to public policy. Their assumption *may* be correct, but it seems fair to ask for evidence.

Some Neglected Factors in the English Industrial Revolution. John T. Krause. *Journal of Economic History* **19**, 4 (December 1959), 528-540.

How similar are current underdeveloped areas to pre-industrial Europe? Many appraisals of population problems stress the resemblance. Krause, on the other hand, emphasizes the differences. In this article he draws on varied materials from his own previous studies and work by others. He concludes that two types of pre-industrial demographic regime should be distinguished. One type, exemplified by "the West" and by Japan, rests on postponed marriage and family limitation. The other type, represented by India, depends on "an equilibrium. . . reached by means of high mortality and low fecundity."

A good deal of evidence of varying degrees of conclusiveness is cited in support of this view. A selection of crude birth rates ranging from eighteenth century Iceland to eighteenth century French Canada suggests wide variations in pre-modern Western fertility. The average for the West was probably significantly below birth rates for many present-day underdeveloped countries. There is also some reason to believe that English fertility rose during the course of the eighteenth century, presumably because of a falling age at marriage, although some of the increase (if it occurred) may have been due to a changing age distribution. These and other data suggest that pre-industrial Western fertility was responsive to economic conditions.

Nor is this all. Hoselitz finds agricultural densities in present underdeveloped areas three times those of pre-industrial Europe. "Sketchy" evidence suggests higher income per worker in Europe, and there seem to have been better diets. From these generalizations Krause infers that mortality was lower in pre-modern Europe than it was elsewhere before Western health measures changed things.

Some of Krause's more speculative hypotheses are that in pre-industrial Europe the poor restricted the size of their families more than others, that malnutrition produces a significant

reduction in fertility in countries like India by reducing fecundity, and that malnutrition and poor health lead to "a stunting of the intellect" so that perhaps "pre-industrial Westerners could learn and think more accurately than can the mass of today's less developed peoples."

Class Fertility Differentials in England and Wales Dennis H. Wrong. *Milbank Memorial Fund Quarterly* **38**, 1 (January 1960), 37-47.

This article extracts a good deal of meat from limited data. Fertility data from the 1951 Census of England and Wales have been tabulated only in five-year groupings for age at marriage and duration of marriage. These are cross-classified with each other and then with (a) social class, and (b) occupational category. Five social classes and twelve occupational categories are distinguished. Some cross-sectional comparisons are possible, although not rigorous comparison of the fertility performance of successive cohorts.

It appears that on the whole fertility differentials among social classes and occupational categories have continued to narrow (up to 1951), although manual — non-manual differences remain clearcut, and may even be widening. The lowest fertility in British society is found among the lowest status non-manual occupations such as shopkeepers and assistants. At marriage durations of less than fifteen years, higher administrative, professional, and managerial fertility (all one category) exceeds all other non-manual categories and even some manual categories.

For marriages initiated around the time of the onset of the "baby boom" and since, the earlier inverse relationship between fertility and socio-economic status seems to have moved toward a J-distribution.

Fertility Trends of the Asian Population of Tanganyika. J. G. C. Blacker. *Population Studies* **13**, 1 (July 1959), 46-60.

Considerable interest attaches to the possibility that Indian fertility might decline under suitable conditions. In 1948 the crude birth rate of the Indian population of Tanganyika was about 41 per 1,000, despite the fact that this overseas Indian population was highly urbanized and generally enjoyed the status of a commercial middle class. The author examines the trend in fertility between 1948 and 1957, using census data. No significant change in the age distribution of the population occurred during the period, but the crude birth rate seems to have declined to about 35 or 36 per 1,000.

The decline appears to have been concentrated in the higher parities, particularly in the rates for seventh or higher order births. These declines are related to a rise in the mean age at marriage, but the decline in fertility among women over thirty has been too great to be solely due to this factor. Inferentially then, there has been an increase in family planning.

Local-born Indian women had lower fertility in both 1948 and 1957 than those born outside the territory, although both groups have experienced a decline during the period. In general, the difference is maintained when age is held constant. The fertility of the Indian population of Dar es Salaam, the one urban agglomeration of over 100,000 in the territory, is lower than elsewhere, and declined by 10 per cent between 1948 and 1957. However, outside this large urban area Indian fertility

declined 14 per cent during the same period.

The author regards the data as insufficient to determine whether the 1948-1957 decline is the beginning of a long-run trend, or simply a short-run fluctuation.

A Demographic Study in an Area of Low Fertility in North-east Tanganyika. D. F. Roberts and R. E. S. Tanner. *Population Studies* **13**, 1 (July 1959), 61-80.

The existence in East Africa of areas of relatively low fertility coupled with high mortality has aroused considerable curiosity among anthropologists and demographers. The authors investigate one such area in north-east Tanganyika, principally three villages selected to fall roughly at intervals along a rural-urban continuum, as measured by proximity to "industrial estates."

Productivity of children in fertile marriages is found to be quite high, with an average of 6.24 live births for continuously married parous women at the end of their reproductive span, in the case of one village. Yet in the same village over half of all unions (regardless of duration) are infertile. This infertility is partly a reflection of the instability of marriages, but in the district as a whole over one-quarter of the infertile unions had lasted more than ten years. The authors do not believe that venereal disease is responsible, nor do they consider birth control to be a significant factor. They conclude that "the available biological evidence is as yet insufficient to explain this infertility."

Extremely high rates of marriage dissolution reflect the breakdown of traditional incentives for maintaining marriages. Pressures from kinsmen are no longer very effective, and there is a marked disparity between the traditionalist views of men and the non-traditionalist views of women regarding their respective marital obligations. The greater the proximity to the estates, the greater the excess of immigrant males, who are perforce unmarried. But even the females in short-supply are reluctant to marry, since traditional marriage forms offer women few advantages. Common-law unions unsanctioned by tradition are said to be the most stable, since they involve less disagreement about reciprocal obligations.

The presence of excess male immigrants, combined with new female aspirations, seems to be leading to the displacement of traditional forms of marriage by irregular (and semi-commercialized) sexual relations unfavorable to fertility. One wonders if the high degree of infecundity implied by the authors may not be a direct or indirect consequence.

Ecological Factors in the Origin of Incest. Miriam Kreiselman Slater. *American Anthropologist* **61**, 6 (December 1959), 1042-1059.

The author proposes a demographic explanation of the origin of the incest taboo. Current theories are viewed as having merit in analyzing the social functions of incest-avoidance but inadequate in explaining the appearance of the pattern. The author believes that under early hominid demographic conditions, incest must have been statistically unlikely. This situation was stabilized by the appearance of culture. Her argument is based on assumptions about age at menarche, adolescent sterility, duration of suckling, onset of meno-

pause, and age at death. Considerable prominence is given to suckling as an inhibitor of fecundity. Models incorporating these factors are developed arithmetically and compared with some data from primitive societies.

On the basis of her models, Slater finds that members of the nuclear family would only rarely have opportunities for mating. In most cases the children would be too young to mate with parents of the opposite sex, or the parents would already be dead. Only siblings of the opposite sex who were also born close together would have much opportunity to mate, and the figures selected minimize this possibility by assuming fairly long intervals between births and low expectation of life.

A demographer would wish for more mathematical sophistication in approaching this problem, with generalized models which would make it possible to examine a wider range of assumptions. Moreover, the importance of adolescent sterility and of lactation as an inhibitor of fecundity is still somewhat problematic and, as the author concedes, her assumptions about length of life are quite speculative. Using average life-spans when mortality risks are not evenly distributed by age is not very satisfactory. Despite the necessity of adding such reservations, the author's analysis suggests an interesting line of inquiry, or at very least, speculation.

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